June 2, 1932

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Engineering News-Record

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Let Us Rebuild!

• • • Today's work is to rebuild what was destroyed in two years of civil war. Stragglers and raiders are still firing some shots, but the war is over. Reconstruction is coming. Alert thinkers and strong leaders are trying to clear the road for it. They need your help, for rebuilding is not the business of a few men, it is everybody's business.

• • • The government is coming to the aid of local public construction. Further aid may come through the efforts now in progress to put idle credit to work. But this support will prove ineffective if blind acceptance of the fatalistic preachments against continued upbuilding of the country is allowed to spread.

• • • We have the common duty of setting in motion as quickly as possible a countrywide resumption of employment through building and creating. Earning power must be regenerated and faith in the future must be re-established. Your community has its part in the work. This country was built by building and will be rebuilt by building. Let us rebuild!

. . . . From an editorial in this issue

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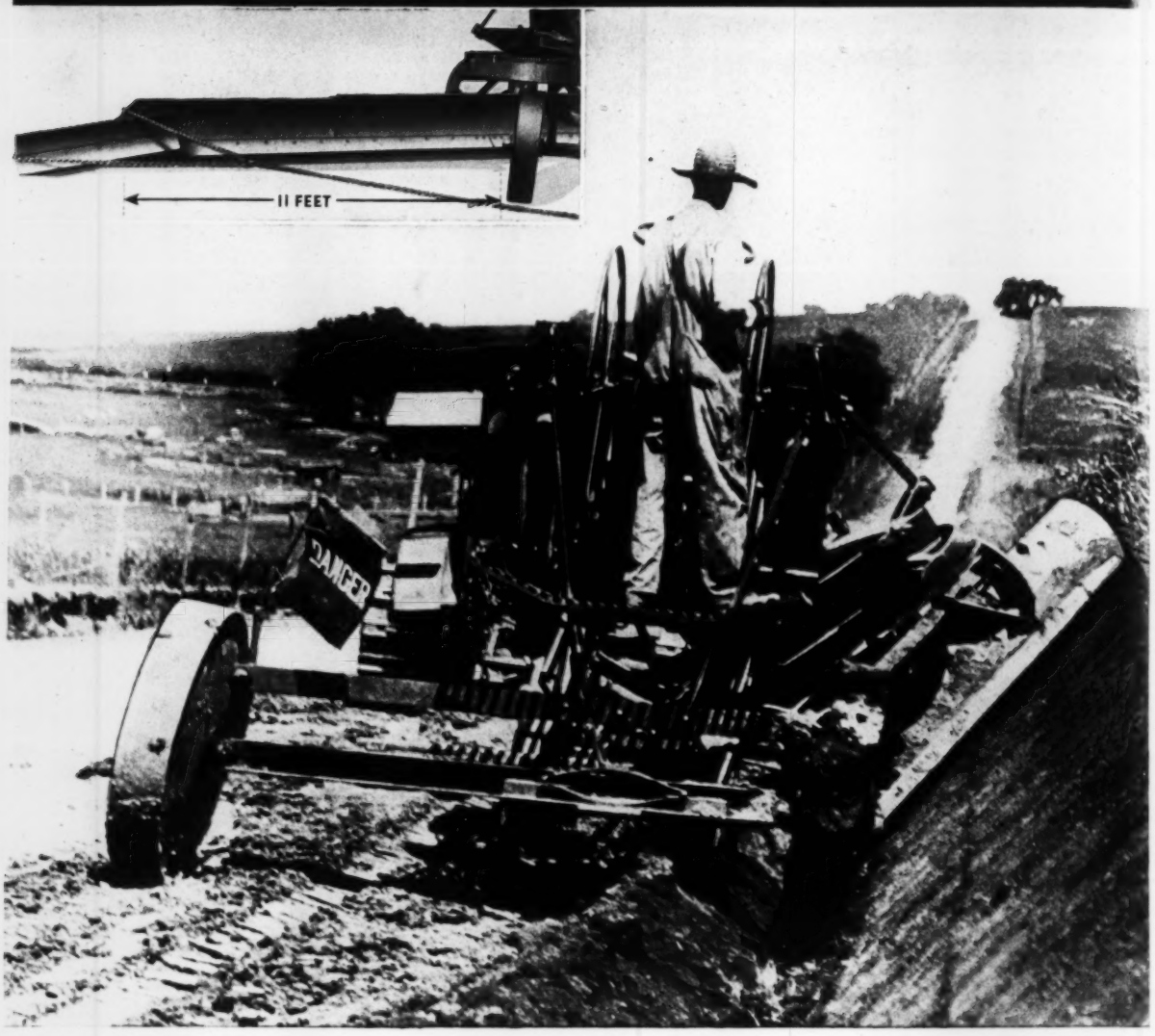

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F. E. Schmitt, Editor

Volume 108 | New York, June 2, 1932 | Number 22

Neither Washington nor Wall Street

JUST AHEAD lies the work of rebuilding what was destroyed in two and a half years of civil war. The long struggle has reached its end in exhaustion, and though stragglers and raiders are still firing some shots the war is over. We now have to repair the damage done.

Reconstruction is coming. In fact, many signs indicate that it is already on the way. A great massing of potential credit by the central bank authorities, preparations in Congress to set work going on a scale large enough to revivify business enterprise, and, most recently, a concentrated group effort by men high in industry and finance to put life into the dead mass of credit, are encouraging evidences of its nearness. But time will be required to arrest the momentum that deflation and discouragement acquired in their long course.

Since rebuilding will obviously be a task of huge dimensions, the attempts of alert thinkers and strong leaders to make a start must be supported by the help of the whole nation. Contraction and idleness have extended their depressing influence into every household, workshop and hamlet, and in each of these the paralysis of initiative and faith must be combated by constructive teachings. Your own help is needed in this service. Reconstruction is not the business of a few men, it is everybody's business.

A NEW SPIRIT is the first requisite of reconstruction. So much impoverishment has resulted from deflation and so many accustomed opportunities have been taken away that a good many men have lost faith in the future and now lack the will to go ahead. These fundamental attributes cannot be expected to return until employment has reawakened hope of stability in human affairs, for the individual as well as the corporation is powerless to plan or venture so long as contraction of activity and spread of fear prevail. These must give way to renewed growth and confidence before credit can work.

That is why hope in the spontaneous reactivation of industry and business has failed, and why all expectations now center in determined action by the community as a unit to restore employment, to revive normal activities and, in final effect, to rebuild the world. That is why the astonishing spread of municipal and state retrenchment has reacted so disastrously on everyone's welfare, on the ability to earn and to pay taxes, on credit and property value. And again, that is why the first great step toward reconstruction is to bring about a resumption of public construction by united public will.

Fortunately this truth is coming to be recognized by men of all classes, from banker to farmer, from laborer to merchant. With the help of such understanding, supported and spread by a broad educational campaign, the efforts of Congress to create employment by construction will lead on to success.

AFTER heartbreaking indecision and delay the government is now moving to aid local public-works construction. Congressional plans have begun to crystallize, and the outlook is brightly hopeful, even though the pending proposals are far from agreement and in part suffer from inflation by unworkable amounts of federal construction. The reassuring fact is that all plans center on the sound feature of credit supply to necessary state, county and municipal work, the greatest reservoir of employment that we have today.

But Congress alone cannot bring back prosperity. Neither Washington nor Wall Street is capable of accomplishing that which, in the last analysis, flows out of the will and convictions of all the people. The present moment therefore calls for a countrywide educational movement that will reach every citizen and business group and bring to them the realization that community rebuilding is the key to reconstruction, that individual faith and enterprise cannot make a fresh start until new public faith finds expression in community advance through resumed public-works construction.

And in this latter respect public faith has sunk to a low point indeed. Apathy, blind acceptance of fatalistic preachments and stagnation induced by fear-born economy have done deadly work. Cities with good credit and resources checked their construction, at first because of the unfriendliness of bankers to bond investments and later through the influence of real-estate propaganda and unjustified fright at the difficult straits to which a few improvident large cities were reduced. State legislatures robbed construction funds to pander to the economy complex. These are the conditions which the educational movement must correct.

TO REPEAT, we have the common duty of setting in motion as quickly as possible a countrywide resumption of employment through building and creating the duty of regenerating earning power and bringing back faith in the future. You and your community will not have done your part in the work until there is a determination to resume public construction, backed by the full spirit and conviction of the community.

All of our progress, from the country's earliest days, has come about through building. So, too, our reconstruction and further progress depend on building. This present task of reconstruction is great enough to enlist the united effort of all, to the end that it may soon be under way.

NOTES OF THE WEEK

Efficiency Is Attainable

TOWNSHIP financing with county aid and direction, as described for Iroquois County in this issue, offers an unusual picture of local road administration. Like many other states having township administration of highways, Illinois can hardly take much pride in the results of such management. Eighteen months ago the state highway engineer said, in commenting on the situation, that for years the townships of Illinois had collected and spent annually some $12,000,000 in road taxes, and yet no results of this expenditure could be seen at the end of the year. This general picture is significant at the moment, because it contrasts so strongly with the brilliant results of township road financing in Iroquois County. While specific figures must be obtained from the article itself, the results can be epitomized in the statement that road taxes have been reduced at the same time that a large mileage of highly improved roads has been built. This experience in a typical agricultural county of the Midwest is capable of being duplicated wherever highway officials have equal energy and purpose.

Avoid Confusion

IN SUCH discussion of the small house as engineers and architects carried on last week—see the report on p. 800—care must be taken not to confuse the subject with the broader and more important one of housing. The individual small house has little chance of relieving the housing shortage that exists in the lower-income groups. It costs too much and probably would continue to do so in spite of economies that mass production might effect. Land is too expensive in cities, where the greatest housing need exists, for the individual house to be considered. Here modern multiple housing units to rent for six to eight dollars per room are the necessity. This distinction between the small house and multiple housing also has an important bearing on estimates made for determining new markets, since the requirements for construction materials per room for the two types of building, are not necessarily the same. The small-house problem is important and deserves attention; better design and construction, lower cost, and particularly better financing, are required. But the small house will not solve the housing problem for those who cannot afford to buy at any price. They are the persons who are in dire need of better living quarters and who also are numerous enough to provide the profitable mass market that is being sought.

Precise Production of Aggregate

MECHANIZATION and automaticity in producing designed aggregates for concrete are extended to quantity production in the aggregate plant for the Boulder Dam operations. This is the distinctive feature of the impressive assemblage of sorting, conveying and cleansing machinery described in this issue. Though the assembly of mechanisms has close counterparts in modern large plants for producing commercial sand, gravel, crushed stone and slag for use in the industries and in construction, this fact does not detract from the outstanding importance of the aggregate plant for the dam, and it is bound to be rated as an unprecedented plant element for a single construction project. In its functioning it is closely related to the remarkable batching and proportioning plant described six weeks ago (*ENR* April 14, 1932, p. 534). There again plant distinction lay in extending familiar weighing, conveying and control devices to large-volume operations. The Boulder Dam aggregate plant extends laboratory refinement of concrete design control into field operations on a scale never previously attempted, and thereby it represents a definite contribution to construction practice.

One Way to Cut Taxes

PROBABLY because municipal utility service charges are easy and sure in collection, cities are turning to this method of defraying their running expenses and a portion of capital charges. A number of Western states, and most recently New Jersey and New York, have passed legislation to authorize the imposition of service charges for sewer connections and sewage disposal. Dayton charges the householder $4 per year minimum, by adding a dollar to the quarterly water bill; it derives enough revenue to cover maintenance and operation and leave a surplus for capital charges. Brockton, the first city to make sewer charges (1890), collects two-thirds of the total cost through service rates and one-third through taxes. The practice of meeting sewerage expenditures by some such combination of service and general tax charges is receiving favor rather rapidly. There are still many uncertainties as to proper charges to heavy users—large buildings, manufacturing plants and institutions—which need to be adjusted, but the service-charge system improves municipal finance by lightening the general tax budget and by distributing payments in proportion to benefits. So long as the unavoidable cost of readiness to serve is taken care of (by tax allocation or equivalent), the system will make city accounting and budgeting distinctly sounder.

Fireproofed Wood

RENEWED interest in fireproofed wood was recorded at the meeting of the National Fire Protection Association in Atlantic City last month. The use of this material is not new, for a large amount of lumber treated to reduce its combustibility was put into use during the early part of the century. Circumstances gave it an unfavorable reputation, however. Recent studies have led lumber and treating concerns to a re-examination of the field of wood so treated. They find many possible uses, but also much skepticism as to what can be done toward making wood reasonably fireproof, if not actual opposition because of past failures. Building codes, with few exceptions, are a further obstacle. Success will require a new public confidence and the development of proper specifications. This process will be slow. If disappointments are to be avoided, reputable firms will have to undertake development of the treating methods on a commercial basis, definite means of marking such lumber to distinguish it from untreated lumber must be established, and exaggerated claims must be shunned. Wood has such attractive advantages in its strength, lightness and resilience, to say nothing of its artistic values, that if fireproofing can extend its applications it will be a valuable addition to our technical equipment.

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Refined Aggregate Production for Hoover Dam Concrete

UNSURPASSED in size, completeness of equipment and provisions for control of product for a single construction operation, the plant built to prepare the aggregates for the 4,500,000 cu.yd. of concrete for the Hoover Dam marks an important development. Design problems centering around three variable factors were met by providing sufficient flexibility in plan and construction to permit, without interference to plant operation: (1) doubling the capacity of the plant from 500 to 1,000 tons per hour; (2) operating either wet or dry; and (3) increasing live storage.

The plant was built by Six Companies, Inc., the contractor for the Hoover Dam, during the past winter and, after a short period of breaking in, is now in active production and furnishing aggregate up to a 3-in. maximum size for the tunnel-lining concrete. The following description covers the operations of aggregate production from the excavation of the gravel in the Arizona pits to the delivery of the graded material at the concrete plant in the canyon.

Fig. 1—Looking down on the aggregate plant from the water clarifier on the hill. Tunnels under stockpiles may be extended to the right as needed. Gravel trains approach from far side. Cleared area behind plant is for raw storage.

Pit development

The raw material for aggregate is a gravel deposit on the Arizona side of the river about 8 miles upstream from the dam. This deposit was proved by numerous test pits to contain about 4,500,000 cu.yd. of suitable river-washed sand, gravel and cobbles, overlain with 2½ ft. of unsuitable material. The sand is clean and sharp, and the gravel and cobbles are well rounded.

Sand and coarse aggregate for all concrete, grout and gunite will be obtained from this deposit. The deposit remains the property of the government, but no charge is made for material removed. The contractor is required to clear the site of desert vegetation, and a bid item provided for stripping the 650,000 cu.yd. of overburden, which is the estimate based on the average depth of unsuitable material. Storage of water in the reservoir prior to the completion of the dam, called for in the contract, requires the removal of material from the pit to be completed before 1935.

The pit is being stripped and the gravel loaded by an electric dragline with a 5-yd. bucket and an 80-ft. boom (Fig. 2). Excavation was started along the river side of the pit to facilitate wasting the stripped material. The gravel is loaded directly into 30-cu.yd. side-dump railway cars. The gravel-pit crew consists of an operator, oiler and pitman and operates three shifts per day.

Aggregate transportation

Transporting about 9,000,000 tons of gravel across the Colorado River during a three-year period presented a major problem. The possibility of using a belt conveyor system from pit to bunkers on the Nevada side was studied, but the cost of rehandling at the terminal bunkers and of providing flexible pit-loading facilities led to a decision against such a plan. A further problem was whether to provide a bridge cap-

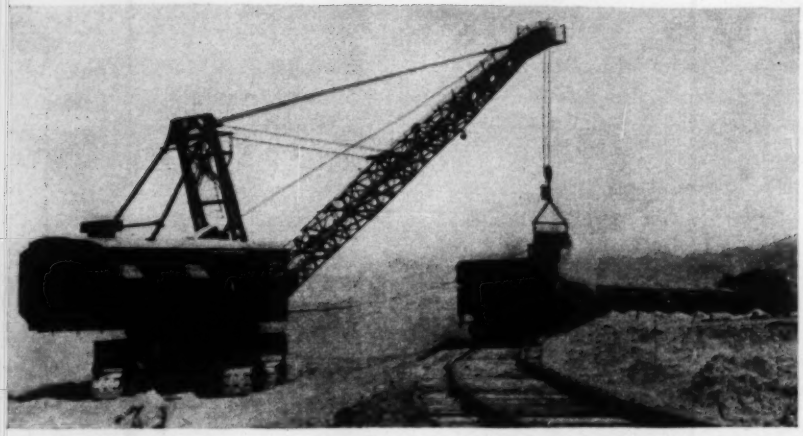


Fig. 2—Two-hundred 30-yd. cars are loaded per day with a 5-cu.yd. dragline at the gravel pits.

able of resisting floodflow or to build a cheaper structure, designed primarily for low-flow conditions, with the probability that it might have to be replaced several times. The conclusion was to build an 850-ft. timber-pile trestle across the river providing for regular train service to the pit. The trestle is strongly constructed, and there is a possibility that it can resist high-water flow. However, it is assumed that the $25,000 structure may have to be rebuilt four times, in which case the plan would still prove cheaper than other proposals.

Operations on the 8-mile standard-gage railroad line between the plant and the gravel pit are carried on by telephone dispatching from the terminals and intermediate sidings. At present three trains are in operation, and the average round trip (including time for loading and discharge) is about 2½ hours. Loading at the pit has averaged about 200 cars per day for three shifts; and although the cars are of 30-yd. rated capacity, the loads probably average about 35 cu.yd. Water for the 150-ton steam locomotives is provided at the screening plant and is furnished by a treatment plant, including water softeners described later.

To allow for possible interruptions during high-water periods when the bridge may be out, a large flat area for storing raw gravel has been cleared near the screening plant. Storage on this area is under way with material that is not required for actual concreting operations, or finished storage, and is approaching 300,000 cu.yd. Trains approaching the plant are directed by semaphore to dump either into the plant hoppers or to proceed to the raw storage pile.

Screening plant

At the time the designs for the plant were being prepared three important factors were unsettled that had direct bearing on the plant layout and equipment. These variables were: (1) lack of definite decision whether wet or dry screening would be used; (2) possibility that the proposed rate of concrete placement might be materially increased; and (3) the amount of live storage to be provided. The solutions, as worked out in the plant design, included: (1) equipping the plant for either wet or dry operation; (2) provision for doubling the plant capacity above the original size without interference with operations; and (3) provision for any reasonable extention of the live storage piles.

The specifications for the aggregate naturally determined the equipment installation. The sand specifications provide, in addition to the usual requirements of freedom from dust, flaky particles, etc., a fineness modulus of not less than 2.75 or more than 3.25. In addition to sand, four sizes of aggregate are required: ¼ to ¾ in., ¾ to 1½ in., 1½ to 3 in., and cobbles up to 9 in.

The site is about 4 miles upstream from the dam and 2 miles west of the river. A near-by hill provides a convenient location for the water-clarification works, permitting gravity supply to the plant.

Four structural-steel screening towers, each 20x30 ft. and 60 ft. high, with connecting trusses supporting conveyor belts and a control tower at the head end carrying the scalping screen, are the main structural features of the screening plant (Fig. 1). At the first tower the raw material, delivered by conveyor belt from the track hoppers, is put through the scalping screen. The cobbles and sand are then removed at the first tower, and each succeeding tower receives the remainder of the screened aggregate on the vibrating screens located near the top. On the next level of each tower, immediately below the floor on which the screens are located, the selected size of aggregate feeds onto a conveyor belt, which is carried by steel trusses a distance of about 80 ft. to a stone ladder and deposited into live storage over concrete tunnels. These tunnels, equipped with electric vibrating feeders, contain the lower ends of return belt conveyors for taking the material back to the lowest level of the towers, where it is rescreened and washed before being loaded by a shuttle conveyor belt into the hopper cars on the opposite side of the tower for delivery to the concrete plant. Individual units of the plant are described in detail beginning at the head end.

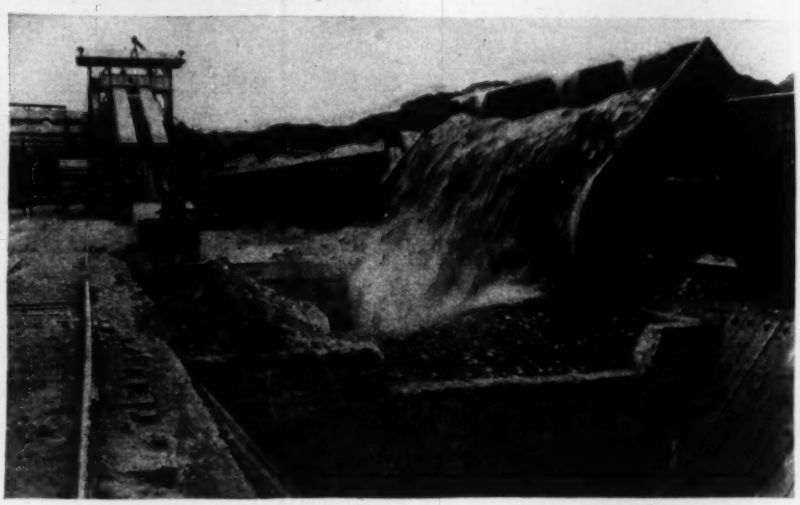


Fig. 3—Raw-gravel hopper and head end of aggregate plant. Feeders under hoppers load 42-in. belt shown leading up to scalping tower. Semaphore on top of operating bridge directs train to plant or raw storage pile.

Trains arriving from the gravel pits discharge into track hoppers (Fig. 3), which have a live storage capacity of three ten-car trains. The bottom of these hoppers is equipped with vibrating feeders discharging onto the horizontal section of a conveyor belt, which transports the raw aggregate to the scalping screen at the top of the first tower. This primary belt is 42 in. wide and was selected to handle readily the maximum size of pit gravel. As a result, the belt is of sufficient size and weight to allow doubling its present load, if the plant requires enlargement, by increasing the speed from 200 to 400 ft. per minute. Thus, the feeder end of the plant is already provided for enlargement without interruption of operations.

At the top of the scalping-screen tower is located the push-button control station from which the entire charging section of the plant is operated. The switches for all individual motors are concentrated at this point for centralized control (Fig. 4). The operator from this location has a view of all operations from the unloading hoppers to the final discharge of the finished product into storage piles. The electrical control is so arranged that stoppage of any individual unit will automatically stop all operations behind the difficulty while allowing operations beyond this point to continue.

Raw gravel is first run through the primary scalping screen, a revolving unit rejecting material larger than 9 in. in size. The rejects from this scalping screen are taken by conveyor to a gyratory crusher from which the product is returned by belt conveyor to the line ahead of the scalping screen.

The product through the scalping screen is elevated to the top of the first 60-ft. tower and passed to the cobble screens with 2¾-in. square holes. In common with all other screens, this unit is a dual set of double-deck vibrating screens having separate motor drives. The product of these screens is delivered by horizontal conveyor belt to the stone ladder for live storage. This material is cobble classification of nominal size, 3 to 9 in.

Material through this cobble screen passes to the sand screens on the next level of the tower, which leaves the ungraded aggregate of sizes from ¼ to 3 in.

Omitting the treatment of the sand temporarily, the aggregate passes to the top of the next tower, where a 1½-in. screen removes the next size of coarse aggregate and then continues to the succeeding towers, where the operation is repeated in producing the various classifications. From each tower the classified material is taken to the live-storage piles by horizontal conveyor belt (Fig. 7). The concrete tunnels under these live-storage piles are designed to permit future extension to provide as much yardage as may be required. Also, each return conveyor belt has a horizontal section so that the introduction of additional feeders and conveyors is simplified.

Analysis of the sand contained in the pit-run gravel indicated that there was a decided excess of the 28- to 48-mesh size that would have to be removed in order to secure the specification modulus. Removal of this part of the sand and the meeting of other specification requirements are accomplished in a plant located between the first and second screening towers (Fig. 8), where it is classified, split, washed and recombined.

The passage through two rake-type classifiers segregates the 28- to 48-mesh size, which is then split. At present, one-third to a half of this classification is removed and wasted. The remainder of the sand material is recombined and passed to a bowl classifier, where the washing action removes the silt content below 200-mesh, and the final product is dewatered by a third raking classifier before transfer to storage piles by a belt-conveyor system extending in tunnel under the loading tracks. The sand plant is so equipped and designed that the operation described can be changed to produce any modulus from the raw product of the pit.

The sand storage has been equipped with tile underdrains to facilitate drainage. Removal of the sand from these piles to cars for transportation to the concrete-mixing plant will be by locomotive crane and clamshell bucket from the top of the pile, and not by tunnel from the bottom as is common practice. This arrangement for sand storage has the intention of eliminating much of the moisture content and providing better control of moisture by selection of the material along the pile. It was recognized that one of the important factors in water control in the concrete

Fig. 4—Push-button control station on scalping tower from which operator can start and stop various units.

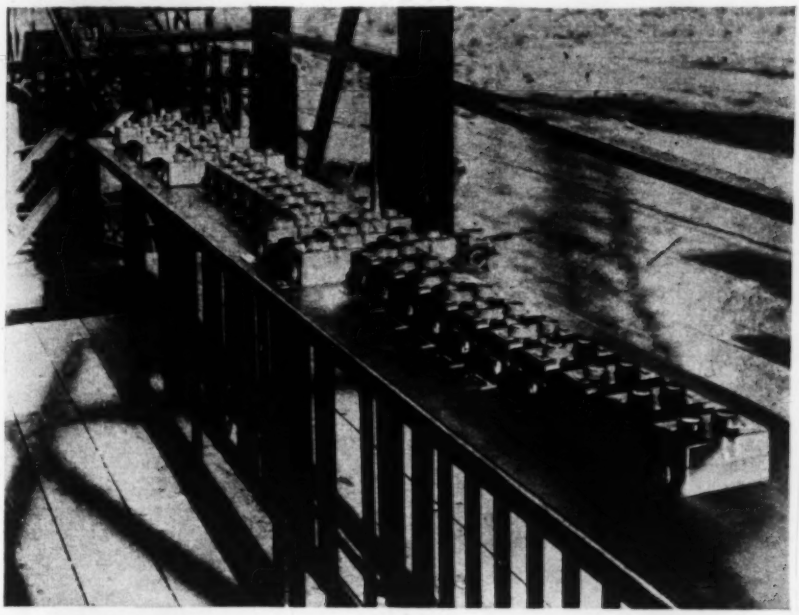
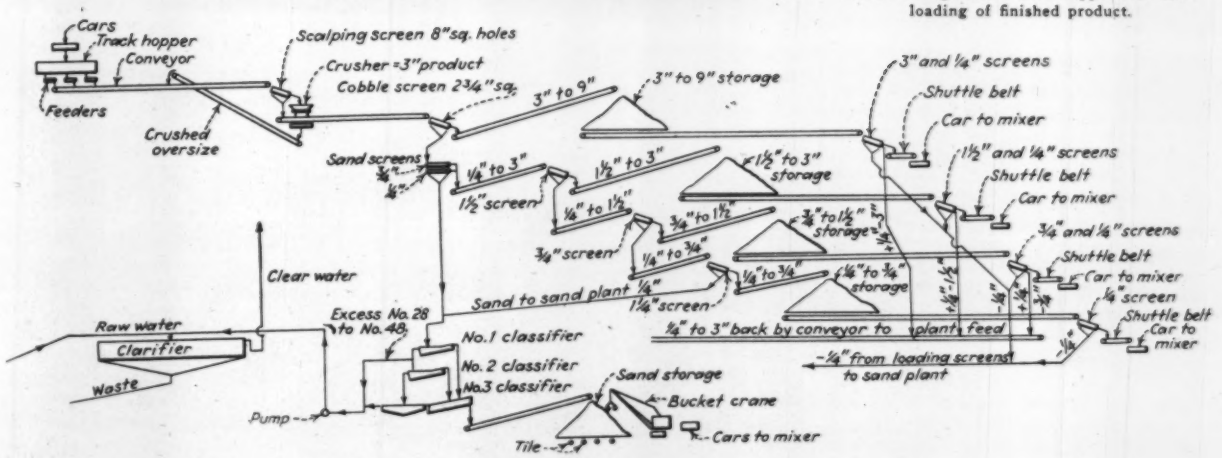


Fig. 5—Flow diagram of aggregate plant from raw-gravel track hopper to car-loading of finished product.



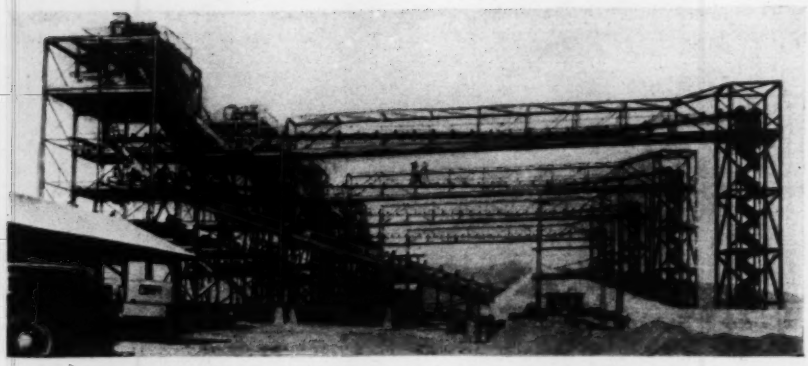


Fig. 6—From screens in towers at left each size of aggregate moves along horizontal conveyor belts, down ladders in towers at right and into live stockpiles.

operations is the moisture content of the sand, and the present scheme was devised to provide the best possible control in a plant where long-time storage is not permitted and production must be nearly in line with use.

As required by concreting operations, the aggregate will be removed from live storage and loaded into 50-ton gondola cars. This operation is accomplished by the return belt conveyors from the tunnels under the live-storage piles to the screening towers. Here each size of aggregate is rescreened through the minimum size screen for that particular classification. This precaution removes any material below the minimum size that might have been produced by breakage of the aggregate, cemented particles or wind-blown debris. The product of this final screening in each case is loaded by shuttle conveyor belts into the cars (Fig. 9). The rejects from these screens are returned by a common conveyor-belt system to the head end of the plant. At present this last screening is followed by a spray wash of the aggregates on the shuttle conveyor belts.

The operation of the entire aggregate-plant system, as described, is shown by the flow-line diagram (Fig. 5). In this diagram the return lines from the storage piles are not shown in their proper relation to the plant, but this can be determined by correlating the line diagram with Figs. 6 and 7.

As mentioned in the statement of design problems, there is the possibility that the plant may have to be enlarged from its present 500 tons per hour capacity to a figure that might be even double this. With this in mind, the entire plant was designed and laid out to permit duplication of the screening and transportation facilities without interfering with the plant operation except in a minor way. Fig. 6 shows a longitudinal view of the plant, and it will be seen that an unobstructed tower panel 20 ft. wide is left next to the present screening towers. Trusses for bridges are stopped on this line, and the intervening space has been designed to permit the introduction of the second unit of screens. The main feeder belt is sufficient for such enlargement and is set at a slight angle with the present scalping screen tower, so that its discharge can be split onto the second screen. In addition, the return belts have been designed so that they can be increased in capacity without undue interference.

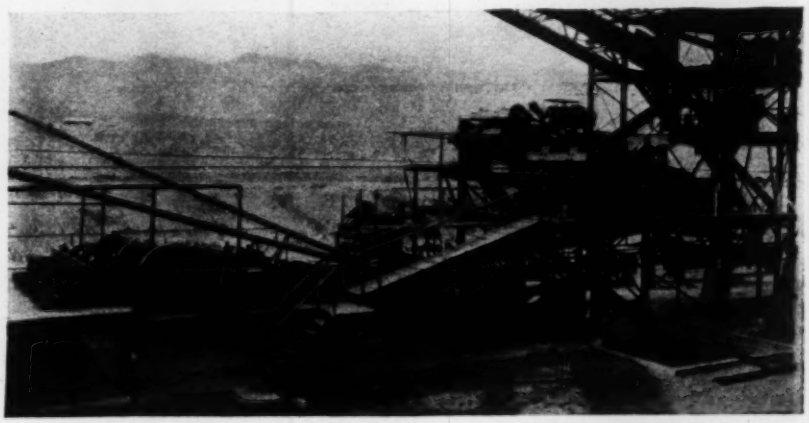
Fig. 7—Typical conveyor, stockpile and return-system unit. In each case storage facilities may be extended to the right as required.

The plant was designed and equipped to operate either wet or dry. At present it is operating dry, except for the sand-classification plant and the rinsing of the coarse aggregates as they are loaded for transportation to the concrete plant. The storage piles are constantly sprinkled to facilitate the rinsing. However, the entire plant is piped with a water-supply system, so that wet separation can be used for all aggregate screening if necessary.

Water supply

Water for the operation of the aggregate plant and for the railroad locomotives is pumped 2 miles from the river and prepared for use on the hill adjacent to the plant. The raw water is lifted by three pumping plants in a 12-in. line to an 800,000-gal. circular concrete reservoir equipped with revolving silt scrapers. Specifications for the wash-water have been made identical with the water to be used in concrete-mixing operations—that is, a turbidity of not more than 500 parts per million. The clarified water flows by gravity to the feed supply of the aggregate plant; a small portion is put through a water-softening plant for the locomotive feed-water supply.

Fig. 8—Sand plant with two rake classifiers at right and final bowl-rake classifier at left.



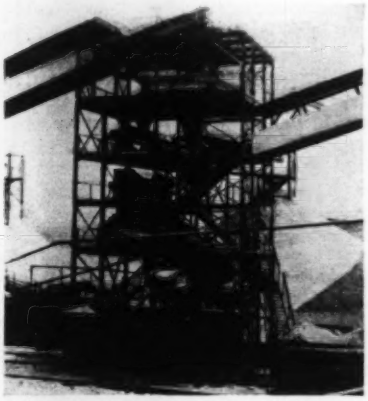


Fig. 9—Typical tower unit, showing material from left at top. Material returned from the stockpile is rescreened and loaded into cars by shuttle belt conveyor.

Water used for washing at the plant is kept in a closed circuit and returned to the clarifier for desilting. It is estimated that about 85 per cent of the water used for washing operations is recovered. Water recovered from the tile drains under the sand storage is returned.

Various sizes of aggregate are loaded into 50-ton hopper-type cars, which are made up into trains by a switching locomotive and are then hauled to the concrete plant. At this point they are discharged into track hoppers similar to those at the aggregate plant and are elevated by a similar belt-conveyor system to the bins above the concrete plant. Features of the concrete-plant batching and mixing equipment have already been described (*ENR*, April 14, 1932, p. 534).

Under the direction of F. T. Crowe, general superintendent, Six Companies, Inc., the aggregate plant was designed, erected and will operate under the direct supervision of T. M. Price, who also is in charge of all operations from gravel pit to delivery of finished aggregate. William Fudge and Olaf Haugen are assistant superintendents. The supervision of aggregate preparation and concrete production for the bureau of reclamation is in direct charge of O. G. Patch reporting to Walker R. Young, construction engineer.

The structural steel frame for the plant was fabricated and erected by the Pacific Iron and Steel Co., Los Angeles.

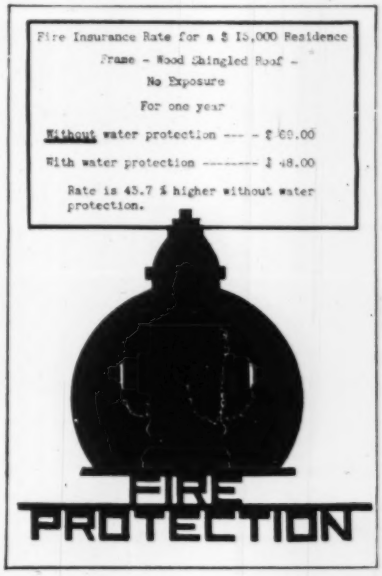
Committee to Study Rail and Road Transport Coordination

A joint committee of rail and road representatives has been appointed by the minister of transport, Great Britain, as a result of a meeting that he held on March 21 with representatives of the four main-line railways and leading road-transport undertakings. Efforts are to be made to establish equitable conditions for both sides of the industry.

Developing Good Will for the Water System

AT A five-day merchandise exposition in Winnetka, Ill., a suburban town of 12,500 people, the water department seized the opportunity to prepare an educational exhibit of the function, operation and place in the community of its municapally owned water utility. From the 10,000 people attending the exposition, with its 75 booths showing attractions that ranged from style parades to radios, the water booth attracted 400 persons. The number who entered the booth and inquired for information was 275, but best of all were the eleven dissatisfied customers. The water system was first explained to these disgruntled citizens, and then the booth attendant took up their particular grievances. For instance, a man whose water bill was doubled after the installation of a new meter was shown the workings of a meter and how it had been tested within 2 per cent accuracy before being placed in his house. This man and the ten others with a grievance all left with a feeling of satisfaction, and to the officials the chance to make boosters out of these eleven complainants was fully worth the $200 the exhibit cost.

Among other things in the 10x18-ft. booth were a complete meter-tesing outfit, a sectionalized meter, a pipe-tapping machine assembled on a 6-in. pipe, a large chart showing the distribution of the water funds, a series of bottled samples of water before filtering, with the maximum turbidity of the year (750 p.p.m.), the zero effluent, samples of filter sand, alum, activated carbon, sodium bisulphite, a 25-lb. cylinder of chlorine and a cross-section view of the filter plant.


Fire Insurance Rate for a $ 15,000 Residence
Frame - Wood Shingled Roof -
No Exposure
For one year
Without water protection --- - $ 69.00
With water protection -------- $ 48.00
Rate is 43.7 % higher without water protection.
FIRE
PROTECTION

One of the typical water uses illustrated was a fire hydrant with a legend comparing insurance rates with and without water protection.

On a 4x7-ft. aluminum-coated board were a view of the complete system and seven large pictures showing typical uses of water in the distribution system.

Agitation for a new plant in a neighboring town led half-a-dozen out-of-town people to study the exhibit in detail and to ply the booth attendant with questions on many subjects ranging from purity to price. The exhibit was prepared under the general direction of H. L. Woolhiser, village manager, by Carl A. Leipold, superintendent of the Winnetka municipal water plant.

On aluminum-coated board seven typical uses of water were illustrated along with a diagrammatic view of the intake, filters, pumps, basins, tower and distribution system.

Roadbuilding Reduces Taxes in Illinois County

Township initiative with county aid and control of construction has provided all-year road system without excessive debt or tax burden

By Benjamin Jordan
Superintendent of Highways, Iroquois County, Watseka, Ill.

IROQUOIS COUNTY, Illinois, is one of the few counties outside of New England where the township has played a major part in road-improvement programs. The methods followed in the county have worked out to the satisfaction of all, and it is believed that this is due to the centralized control of the county over township affairs. While the townships have supplied the incentive for road work, they have had very little control over the work beyond supplying money. The laws require that the roads improved be on the state-aid system designated by the county board, and all work is under the control of the county superintendent of highways. The township's wishes are followed in regard to the order of road improvement, but in every case the roads in the townships have been improved in the order of their traffic importance. The results of this policy and the practices followed in carrying it out are summarized in the following article.
—EDITOR.

ROADBUILDING in Iroquois County began in 1914 with the construction of 6.7 miles of single-track concrete road 10 ft. wide. This work was a direct result of new state-road laws enacted in 1913, which established a system of state-aid roads in every county, empowered the state to match county expenditures on a 50-50 basis and provided for the appointment, after examination, of county superintendents of highways in all counties. Since that time the construction of single-track concrete roads has continued until 144.99 miles had been built by the end of 1931.

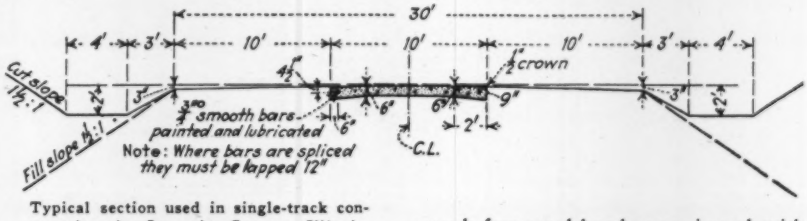
Iroquois County is a typical Illinois agricultural community with corn and hogs the predominant farm products. Sweet corn is also raised for canning, and all these products require usable roads at marketing time regardless of weather. The county has an area of 1,121 square miles and a population of 32,913, and the largest town (Watseka, the county seat) has a population of 3,144.

Financing plan

At first, roadbuilding in the county was largely on a pay-as-you-go basis. As the farmer realized the value of paved roads, sentiment developed for their more rapid extension. In general, each township felt it was responsible for its roads and should provide the money for improving them without recourse to a general county road tax. The writer suggested that the state-aid plan could be made to operate in the county by the county pledging aid to the township for their road work on a basis of equal expenditure. This plan was inaugurated by a resolution passed by the county board of supervisors, Feb. 12, 1919. It provided that county aid should be extended in the order that funds were provided by the townships.

Following the passage of this resolution, the county superintendent of highways prepared rules and regulations very similar to those established by the U. S. Bureau of Public Roads to carry out the provisions of the federal-aid road law.

Almost immediately seven townships



Typical section used in single-track construction in Iroquois County, Illinois.

authorized road bond issues totaling $355,000 for single-track construction. Twelve other townships have since issued road bonds for $1,201,000 (a few for gravel-road construction), making a total of $1,556,000. Most of these bonds have been retired; the bonded indebtedness of the townships for roads is now about $500,000, and $130,000 of this was voted in 1931. Table I shows the bond issues of the townships.

Iroquois County has never levied a county road tax nor authorized a county bond issue for roads. County expenditures have always been appropriations from the general tax revenues. In years past, $80,000 to $150,000 has been appropriated, but of late years the appropriations have slowly decreased until now the general county property taxes contribute practically nothing for road-building. The costs of other local governmental functions have increased, and these increases have been taken care of by decreasing road appropriations.

In recent years the county has met its obligations to townships from state refunds on single-track state-aid roads and roads incorporated in the state-bond-issue system of roads, and most recently from gas-tax refunds from the state. The gas-tax refunds now average about $58,000 a year and will permit the count to meet township construction without making road-tax levies or appropriating from general property-tax levies.

Tax reflections

The influence of single-track road construction on property taxes can be determined by comparing the township-road and bridge-tax levies in 1919, the last year before road bonds were issued, with the same tax levies in 1930, after the roads were built and the bonds matured. Table II shows the townships voting bonds in 1919 for single-track construction that matured before 1930, their total road and bridge tax levies for 1919 and 1930, total taxes for 1919 and 1930, and the per cent decrease in road taxes.

It will be noted that the property-tax levies for roads decreased from $\frac{1}{4}$ to $\frac{2}{3}$ of the total property tax of 1919 to $\frac{1}{11}$ to $\frac{3}{20}$ of the total property tax in 1930.

Bridge built by county in 1931 on state-aid route. All bridges are constructed wide enough for two lanes.

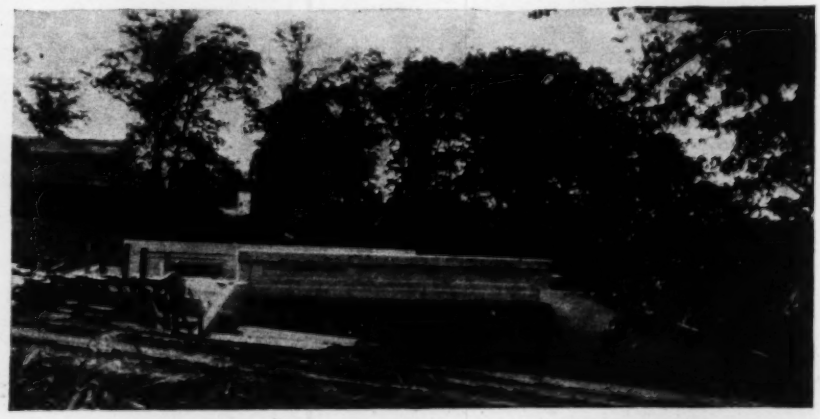


TABLE I — TOWNSHIP BOND ISSUES AUTHORIZED IN IROQUOIS COUNTY

Township	*Order Voted	Year Voted	Amount	Term, Years	Year Met by County
Fountain Creek	1	1919	$50,000	5	1921
do.	15	1922	40,000	10	1927
do.	25	1929	63,000	10	....
Belmont	2	1919	10,000	10	1921
do.	5	1919	50,000	10	1921
do.	27	1931	50,000	10	....
Beaver	3	1919	33,000	5	1921
do.	17	1923	26,000	10	1928
Lovejoy	4	1919	50,000	5	1921
Milford	6	1919	50,000	10	1921
do.	26	1931	80,000	10	....
Ash Grove	7	1919	55,000	5	1922
do.	22	1927	90,000	10	....
Ashkum	8	1919	90,000	10	1922
Papineau	9	1919	40,000	10	1922
Chebanse	10	1920	65,000	5	1923
do.	21	1927	75,000	10	....
Danforth	11	1920	111,000	5	1924
Martinton	12	1920	45,000	10	1926
Sheldon	13	1921	37,000	5	1926
Middleport	14	1921	20,000	3	1927
Pigeon Grove	16	1922	69,000	10	1928
Beaverville	18	1924	38,000	10	1930
Stockland	19	1926	80,000	10	1931
Milks Grove	20	1927	78,000	10	....
Anargo	23	1928	96,000	10	....
Crescent	24	1928	55,000	10	....
Total			$1,556,000		

*Also signifies the order in which aid in an equal amount is extended by the county. For example, the first road money spent by the county in 1932 will be spent in Milks Grove township. Upon completing road work costing $78,000, the county will extend aid in Chebanse township until $75,000 has been spent, etc., in order.

TABLE II — TAX RATES AND DECREASES IN TOWNSHIPS IN IROQUOIS COUNTY, BEFORE AND AFTER BONDS FOR SINGLE-TRACK ROADS WERE RETIRED

Township	Total Road and Bridge Property Tax Levies 1919	1930	Per Cent Decrease	Total Tax 1919	Total Tax 1930
Ashkum	$21,218.51	$10,849.65	48.9	$66,074.62	$69,842.67
Belmont	20,073.52	4,575.37	77.2	54,526.84	51,440.96
Lovejoy	18,995.95	6,296.22	66.9	47,985.72	41,726.11
Milford	17,721.15	8,989.81	49.3	68,114.54	72,836.26

TABLE III — PROGRESS OF ROAD-CONSTRUCTION WORK IN IROQUOIS COUNTY SINCE 1914

Year	10-Ft. Concrete	16-Ft. Concrete	18-Ft. Concrete	14-Ft. Gravel
1914	6.70	....	....	.....
1916	.....	....	....	.....
1919	.....	2.06	....	.....
1920	.....	1.02	....	.....
1921	16.73	....	....	6.06
1922	29.52	....	0.45	14.31
1923	16.01	....	....	3.09
1924	9.18	....	....	3.23
1925	.....	....	....	3.50
1926	.....	....	....	5.19
1927	10.75	....	1.55	2.92
1928	13.86	....	....	3.87
1929	10.83	....	....	.....
1930	14.24	....	....	2.37
1931	17.16	....	....	.....
Totals	144.99	3.08	1.99	44.54

There was also 9.09 miles of 14-ft. bituminous macadam built in 1914.

The actual levies for roads, after single-track construction, decreased from 49 to 77 per cent of those levied before the roads were built. In addition, county appropriations from general taxes have decreased from a maximum of $180,000 a year to practically nothing, and in the meantime road service has increased.

Exact accounting

The construction of the roads in the townships has all been under the supervision of the county superintendent of highways, who in turn received advice from the state highway department. All expenditures have been carefully accounted for, and the records are available in the office of the county superintendent and in the county court house. These records are invaluable to obtain state refunds for state-aid roads or roads taken over by the state on the bond-issue system of roads, to determine county aid to townships, and to allocate the costs of maintenance on the state-aid roads maintained jointly by the county and the state. They also make it easy to determine the progress made in road-building in each township and in the county as a whole. Table III shows the work that has been accomplished on the state-aid-system in the country to the end of 1931.

Maintenance costs

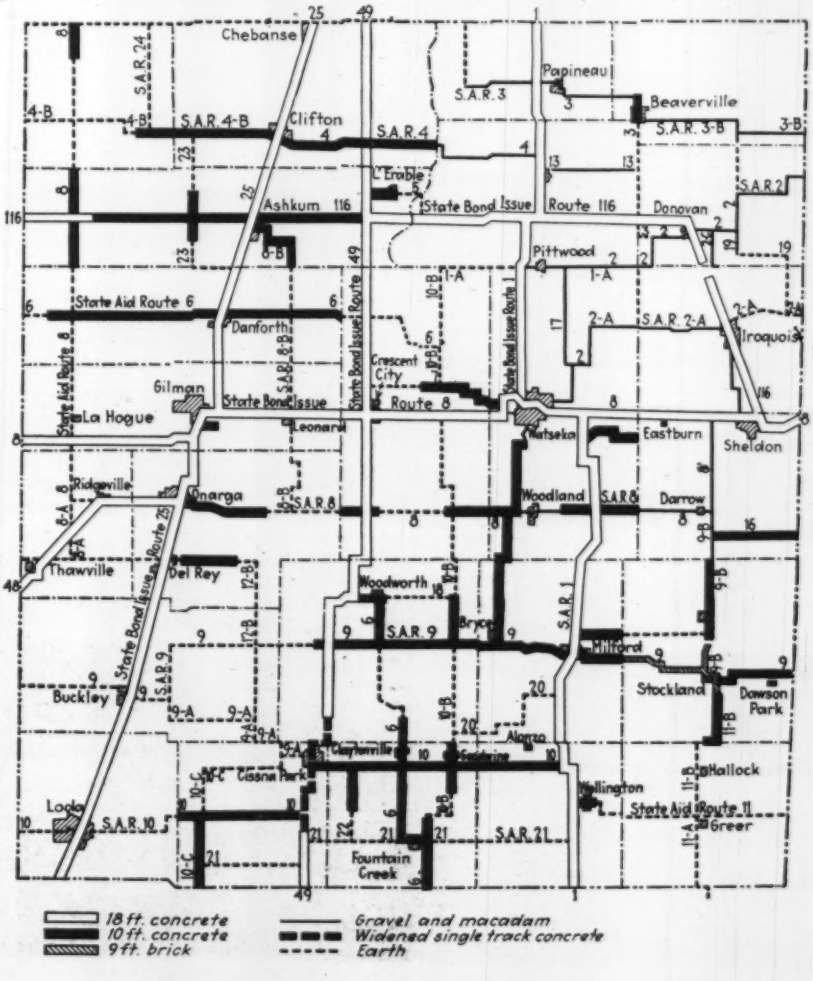
The maintenance costs of the single-track concrete roads are carried by the state. These costs, as shown by figures from state highway department records for typical sections aggregating 46.50 miles, were $54.60 for the slab and $19.06 for the earth shoulders, or $73.66 per mile per year for the traveled roadway. The maintenance costs on the state-aid earth roads before the single-track roads were built averaged well over $200 a mile a year to give service for only part of the year.

The traffic carried on these single-track concrete roads, ranging upward from 200 vehicles per day, is an item because of the influence on the earth-shoulder maintenance. In the late summer, when sweet corn is being harvested for canning, it is not unusual for these roads to carry 100 to 200 trucks per day in addition to many tractor trains of three wagons. It is a little surprising to find that most of these single-track roads have sodded shoulders in spite of this heavy traffic. Ruts along the edges of the concrete are unusual, even in the spring.

The gravel roads built by townships on the state-aid system now total about 45 miles and are maintained at the joint expense of the county and state. Their maintenance costs are available from county records. These figures for eleven years are shown in Table IV.

Although the traffic on the gravel

Road map of Iroquois County, showing various types of roads in relation to state-system routes.



roads is less than on the single-track roads, the maintenance costs average about three times more. This is due to break-ups during the spring and fall months. In addition, considerable dragging is necessary to keep the surface even reasonably smooth, and material must be replaced periodically.

The construction costs of single-track concrete roads since thq first road was built in 1914 have averaged $16,710 a mile. This cost is somewhat higher than the cost of the 1931 contracts, as seen by the average total cost of the 17.16 miles awarded during the year, which was $13,856 per mile. The cost of 44.5 miles of gravel road has averaged $10,060 per mile.

TABLE IV — MAINTENANCE COSTS OF GRAVEL ROADS, 1922-1932, INCLUSIVE

Year*	Miles Maintained	Total Cost	Cost Per Mile
1922	6.06	$1,009.00	$166.40
1923	20.37	2,826.00	138.85
1924	23.46	4,743.00	202.11
1925	26.69	83.00	3.10
1926	20.19	6,225.00	206.16
1927	35.38	4,623.00	130.66
1928	38.30	4,730.00	123.50
1929	42.17	4,983.00	111.04
1930	42.17	8,889.00	210.78
1931	44.54	10,068.00	226.04
1932†	44.54	11,500.00	255.73

*Fiscal year ends June 30.
†Estimated.

Construction practice

The construction practices followed on the 1931 work in Belmont, Milford and Stockland townships are typical of work for the past several years. The standards used have been approved in detail by the state and are shown in the accompanying sketch.

Construction work on single-track concrete county road.

Grading usually averages about 5,000 cu.yd. per mile. Full-width bridges and culverts are built to permit widening the road to two lanes. One of the longer bridges under construction is shown in an accompanying illustration.

Construction follows state specifications to the letter. Materials are proportioned by weight, water is carefully controlled, and the slump of the concrete is kept constant. Pavement-finishing procedure consists in using a machine without a belt, followed by a longitudinal float, a long-handled float, a straightedge and a canvas belt. The smoothness specification requires no surface irregularity of more than $\frac{1}{8}$ in. in 10 ft.

The contractor finds that single-track construction has several advantages for him. It is possible to keep 1,000 to 1,200 ft. of finished subgrade and forms ahead of the mixer at all times because the mixer travels on one of the 10-ft. shoulders and the trucks use both shoulders. The required surface smoothness is easily secured because the two side forms, only 10 ft. apart, give close control points, and the crown of $\frac{1}{2}$ in. is not easily worked out.

The construction work last season was under the supervision of O. M. Gillaspy, R. C. Davis and V. D. Ehringer. The weight proportioning of aggregates was supervised by Abe Miller. The contractor was required to supply a small shed as a testing laboratory for the tests made at the proportioning plant.

A typical section of completed single-track road in Iroquois County. The shoulders remain sodded even under rather heavy traffic.

The county's immediate plans call for the paving of 45 miles of single track from gas-tax, state-aid and state-bond-issue refunds. This work is needed to fulfill the county's obligations to townships for construction work already completed by them. A total of about 20 miles will be built during 1932, leaving 25 miles still to be built by the county as township-aid roads.

Groundwater Investigation on Long Island, New York

For many years large quantities of groundwater have been pumped from wells for public supplies on Long Island, and several reports have been written describing the groundwater conditions on the island as revealed by the early developments. In order to obtain and study information in regard to developments since the publication of these earlier reports, an investigation of the groundwater supplies of the island was begun in January, 1932, by the United States Geological Survey, Department of the Interior, in cooperation with the joint legislative committee investigating the water resources of the state of New York. It is contemplated that the investigation will continue for at least two years. The investigation so far has been confined to Nassau County and the boroughs of Brooklyn and Queens, but plans are made to extend it into Suffolk County.

As a result of hearings on an application of the department of water supply, gas and electricity of the city of New York to the state water-power and control commission for permission to divert an additional quantity of water from wells on Long Island, the Geological Survey has received requests for the data that have already been collected in its investigation. Arrangements have been completed to make these data available by depositing manuscript copies of the records in the main office of the Geological Survey in Washington, D C., in the office of the county engineer of Nassau County, Mineola, N. Y., and in the office of the chief engineer, department of water supply, gas and electricity of the city of New York, Municipal Building, New York. At all these offices the records are open to public inspection. Copies of the records, in blueprint form, can also be obtained at the cost of printing. The data to be deposited are largely of a statistical nature and relate to quantities of water pumped for public supplies, depth to water, depth of wells, etc., in different parts of the area under investigation. Additional data will be similarly filed for public inspection as they become available and can be compiled for release.

Skew Bascule a Strange and Unique Structure

Diamond-shaped span in New Jersey on 66-deg. skew, with trunnions and concrete counterweight carried at one side, involved an intricate design problem to eliminate torsional strains during operation

By Wm. Guy Williams
Formerly Associate Engineer, Waddell & Hardesty, Consulting Engineers, New York, N. Y.

THE DEMAND for straight highway alignments that modern motor-car speeds have created has made skew bridges much more numerous than they once were. The difficulties involved in their design are well known. Fixed skew bridges often present complicated problems, but seldom are they so complex as those encountered in the skew bascule described in this article. With the counterweight located far to one side of the center of gravity of the span, torsional strains assumed paramount importance. Mr. Williams describes how these were minimized by the design selected, and in a second article, immediately following, the intricate erection problem occasioned by assembling the bridge in its open position is outlined. —EDITOR.

A SINGLE-LEAF bascule bridge, unusual by virtue of a 66-deg. angle of skew, has recently been put into service by the New Jersey state highway department, between Trenton and Princeton at the crossing of U. S. route 25 over the Delaware and Raritan canal. This heavily traveled road has a practically straight alignment from near New Brunswick to Trenton, a distance of more than 20 miles, except at the bridge site, where an old narrow retractible type structure, located to cross the canal at a relatively favorable angle, caused a sharp kink. Elimination of this kink and the old bridge became necessary as a safety measure. The new bascule bridge has a 40-ft. roadway and provides a crossing on the straight alignment of the roadway. In plan the span is a diamond or lozenge having a short diagonal of 45 ft. and a long diagonal of 207 ft. The main trunnion is located on an extension of one of the short sides, and in operating the span revolves about this short side.

Choice of type

Before the final design of the new bridge was prepared, consideration was given to every type of movable span that appeared to offer a possible solution to the problem, including swing, vertical-lift, bascule and retractible designs. The most suitable swing-bridge design had a single leaf span, square on one end and skewed on the other, with the span pivoted at one square corner and carried on wheels running on curved tracks. A considerable amount of counterweight was required to balance the load on the wheels. Other less satisfactory swing-bridge designs had double-leaf spans, made by cutting the span in various ways with longitudinal, transverse or diagonal joints. The vertical-lift design had a lozenge-shaped span and a four-legged tower with overhead bracing extending across the canal. Among the bascules considered were single-leaf and double-leaf spans of various designs. In the double-leaf designs the lozenge-shaped span was cut into two triangular leaves by a joint along the short diagonal, extending across the canal as well as across the roadway. Each triangular leaf in these designs was arranged to rotate about its trunnions on one side of the canal and to be supported by the trunnions on that side and by one live-load shoe under the toe corner of the leaf on the opposite side of the canal. A double-leaf Bélidor bascule span proved to be one of the most economical of all the designs considered; and a double-leaf simple-trunnion bascule span with underneath counterweights was the most satisfactory in appearance.

In selecting the type the problem was to find the cheapest satisfactory bridge that could be built. On account of possible future changes in the canal it was not considered desirable to increase the cost for the purpose of obtaining permanence or better appearance. The estimates of cost were not greatly different for the single-leaf swing span, the vertical-lift, the double-leaf Bélidor bascule or for the single-leaf simple-trunnion bascule. The latter was finally selected for the reason that it could be built with the least interference to highway and canal traffic. Also, of all the designs considered, it probably is the most satisfactory from the standpoint of

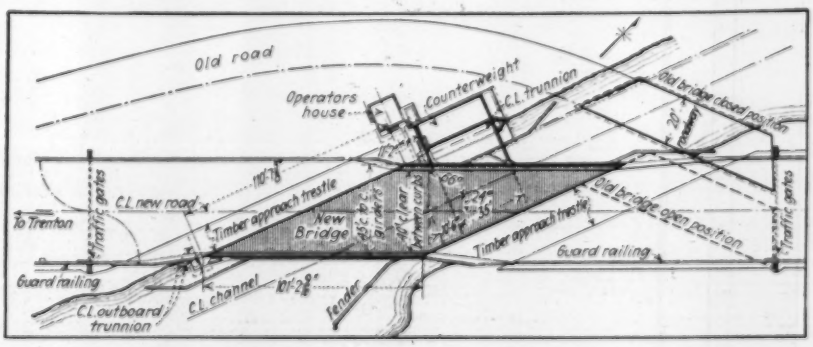
Fig. 1—Skew bascule span over Delaware and Raritan canal in New Jersey operates by revolving about one of its short sides. Counterweight trunnions are on an extension of this axis of revolution. Old bridge in foreground of retractible type has been removed.

the arrangement of its structural and mechanical parts. Although the span that was adopted may not be called beautiful, it was considered acceptable in appearance for the location, as it does not have the ugly overhead work that characterized some of the other designs.

Framing layout of leaf

The substructure at the trunnion end of the bascule span consists of a reinforced-concrete tailpit and four small reinforced piers connected at the top by a reinforced-concrete girder. The substructure at the toe end is of similar construction. The tailpit and piers are founded in a firm bed of coarse gravel, the piers having reinforced spread footings. The bascule span itself is of very shallow construction, considering the length of some of its members. The height of the crown of roadway above the water is only 7 ft. 10 in., and the total depth of the structure from the crown of roadway to the under clearance is 6 ft. 6 in. It is of through-girder type, with the two longitudinal girders spaced

Fig. 2—New skew bascule span on heavily traveled state road between Trenton and Princeton, N. J., eliminates dangerous kink in alignment and an old narrow bridge of retractible type.



45 ft. on centers. Although the width of the waterway, only 28½ ft., is clear between the fenders, the length required for the longitudinal girders is 101 ft. c. to c. of end bearings. The end floor beams, placed parallel to the center line of the canal, are 110 ft. long and less than 6 ft. deep. The intermediate floor beams, which are placed at right angles to the longitudinal girders, are spaced 14½ ft. on centers. One floor beam lies on the short diagonal of the lozenge-shaped span, the amount of skew being such that the east end of one longitudinal girder is exactly opposite the west end of the other. The other floor beams are of various lengths, due to the condition that one end of each of them is connected to a longitudinal girder, and the other end to a skew floor beam. A very complete system of lateral and stringer bracing is required for carrying the weight of the various parts of the span when it is in the open position. Stringers on 2-ft. centers carry a floor of 4x12-in. untreated long-leaf pine planks bolted directly to them with galvanized carriage bolts.

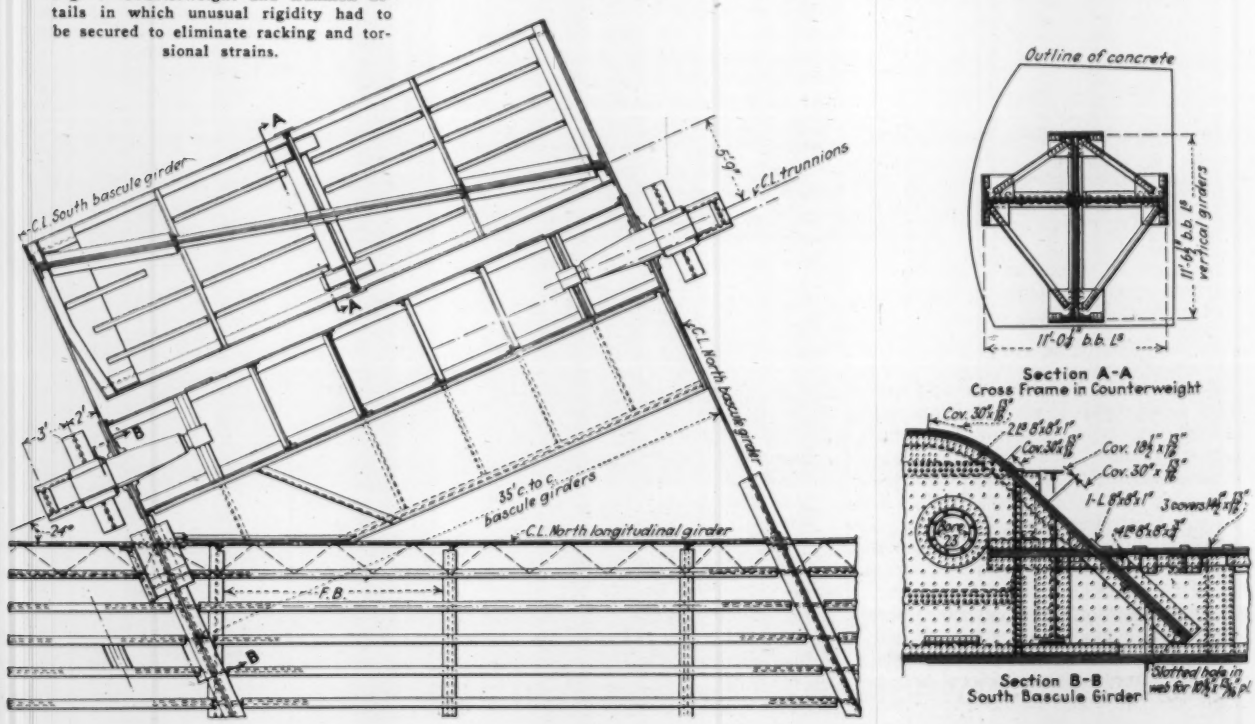
Fig. 3—Skew bascule span assembled in fabricator's yard, showing leaf and counterweight trunnion framework.

Trunnions and counterweight

The center line of the trunnions is at curb level, slightly back of and parallel to the heel-end floor beam. The extreme angle of skew makes a single counterweight possible, placed on one side of the road and at the elevation that is best suited for a logical and economical design. The bascule leaf and the counterweight are rigidly connected to a pair of bascule girders placed at right angles to the canal center line and supported by a single axle with outboard bearings, the axle consisting of a square-box trunnion girder, and two forged-steel trunnions. Each trunnion forging is fitted into a hole bored through the bascule girder, the inboard end of the forging having an adjustable connection to a diaphragm located 5 ft. from the end of the trunnion girder. The journals at the outboard ends of the trunnions are carried in simple pedestal bearings supported by a structural-steel grillage girder resting directly on top of an end wall of the counterweight pit. Both trunnions are beyond the north end of the heel floor beam, but as near the corner of the span as the arrangement of the details permit. The acute corner of the span at the other end of the heel-end floor beam, and 123 ft. from the south counterweight bearing, is carried by a similar but smaller trunnion and bearing adjustable in position to insure an exact alignment with the two counterweight trunnions and bearings. The entire bascule leaf with its counterweight is a single moving unit supported on the three trunnion bearings in line.

Although the bascule girders were placed as near the center of the leaf as details would permit, practically all the

Fig. 4—Counterweight and trunnion details in which unusual rigidity had to be secured to eliminate racking and torsional strains.



weight of the leaf is carried by the south girder. On the other hand the concrete counterweight, uniform in cross-section and 35 ft. long, imposes equal loads on the two bascule girders. The bascule leaf, counterweight, bascule girders and trunnion girder, considered as a single unit, have a large internal torsion or twisting moment along the axis of rotation, since the central plane of the moment of the leaf about the axis is near one bascule girder, while the central plane of the moment of the counterweight is offset to a position midway between the two bascule girders. The unit is in balance, however, since the sum of the moments about the axis of rotation is zero. The actual distribution of stresses in the various parts is highly indeterminate, as the torque is divided between at least four independent systems. First, both bascule girders intersect the north longitudinal girder, and both are connected to the toe floor beam; this system of girders in the bascule leaf is suitably arranged for resisting any loads tending to warp or twist the leaf. Second, the trunnion girder is a square tube that has both the strength and the rigidity requisite for carrying torsion, and the end connections of this girder are suitably arranged to carry such stresses. Third, the concrete counterweight has great strength and great rigidity against torsion, but the connections of the ends of the counterweight to the bascule girders are necessarily dependent upon the structural framing of the counterweight. And fourth, some part of the torsion must be carried by the counterweight framing.

Fig. 5—South bascule girder, whose top chord is shown in this view penetrating the web of the north longitudinal girder, carries practically the entire weight of the leaf and is the heaviest member in the bridge, weighing 34 tons. It is 58 ft. long.

Counterweight-framing design

If all the torsion load in the skew bascule leaf were imposed upon the counterweight framing, it would have the effect of placing the counterweight reactions about 18 ft. from the center of the trunnions on the inner bascule girder and about 2 ft. on the outer bascule girder. Each of these reactions would be about 2 ft. outside the faces of the concrete counterweight. Although the counterweight framing could easily have been designed for carrying this amount of torsion, another scheme was adopted, which effected a saving in metal and at the same time eliminated most of the uncertainty regarding the distribution of the torsion. The counterweight is supported by one horizontal girder and one vertical girder, which intersect each other longitudinally, the line of intersection passing through the center of gravity of the counterweight. The vertical girder is cut longitudinally into two halves by the horizontal girder, and the two halves are spliced together with long clip angles and with field-driven rivets that extend through the web of the horizontal girder. The vertical girder is placed in a diagonal direction, supporting the counterweight at two diagonally opposite corners. The connection of each end of the pair of counterweight girders is concentrated into as small an area as practicable to prevent its carrying any large amount of torsion, and for the same reason the concrete of the counterweight is kept out of contact with each bascule girder except on a small area inclosing the counterweight girder connections. By this framing arrangement most of the torsion on the rotating unit is definitely imposed upon the reinforced concrete of the counterweight, but a small part is left to be carried by the trunnion girder and by the girders of the bascule leaf. In the design of the trunnion girder and the leaf girders, allowances were made for the torsion that must be carried by them, and an excess of strength is provided in each part to allow for the uncertainty of the assumed distribution.

The heaviest member in the bridge is the inner or south bascule girder. It has a weight of 34 tons, a length of 58 ft., a depth of 12 ft. at the tail end, to which the trunnion girder and the counterweight girders are connected, and a depth of 6 ft. at the toe end, which extends under the roadway deck. Each of its flanges has a sectional area of 75 sq.in. At a re-entrant corner bend in the upper flange, which is made necessary by the differing depths of the two ends of the girder, the flange sections from the two ends of the girder intersect; and a flange splice is made by extending each section beyond the intersection, the section from the tail end having 30-in. coverplates notched to allow the flange angles and the 14½-in. coverplates from the toe end to pass through (Fig. 4). The web is reinforced locally to make up the section cut out by the trunnion passing through it, to provide sufficient area in bearing on the trunnion forging, and to provide the additional strength in the flange riveting that is required by the radial components of the flange stresses carried around the sharp bends of the flange. At the trunnion the web consists of seven plates, which have an aggregate thickness of 5⅛ in. This girder was fabricated with 1-in. rivets, the maximum rivet grip being 6 in.

The live load on the bascule leaf is carried by the trunnions and by additional live-load shoes. One shoe is placed near each of the two toe corners of the span, and an additional shoe is placed near the mid-length of each end floor beam to keep the flange areas and deflections of the shallow floor beams within reasonable limits.

The central plane of the dead-load moments of the bascule leaf about the trunnions, and likewise the central plane of the operating moment due to any combination of friction, inertia, wind and snow, is very near the plane of the inner bascule girder. This condition makes practical the use of a very simple arrangement of the operating machinery. An arc of rack segments is attached to the tail extension of the inner bascule girder, and this rack is engaged by the main pinion. This pinion, together with three steps of spur gearing, of which one step is arranged as reversing gears, is assembled into a single compact unit. The span is arranged to be driven by a six-cylinder 85-hp. gasoline engine with a friction clutch. The reduction ratio of the gear train, between the engine shaft and the main pinion, is 322 to 1. A hand-operated band brake and a capstan for operating the span by hand in emergency are provided.

The steel framing for the entire bascule leaf and counterweight was assembled in the shop. During the shop assembly, while the span was warped to compensate for dead-load deflections in the completed structure and the cambered girders loaded to take out the camber, all field connections were reamed.

The bridge was built by the New

Jersey state highway department, but the owners of the canal, in which the Pennsylvania Railroad has an interest, participated in the cost. For the state highway department Jacob L. Bauer is state highway engineer, and the work was done under the immediate direction of Morris Goodkind, bridge engineer. The design and the construction was subject to the approval of T. W. Pinard, engineer of bridges and buildings for the New York zone of the Pennsylvania Railroad. Waddell & Hardesty, consulting engineers, New York City, prepared the design and specifications; and the writer, being in charge of their part of the work, devised the arrangement and the controlling details of the bridge. L. Whitehead was resident engineer for the state highway department. S. S. Thompson & Co., Red Bank, N. J., was the general contractor. The steel work was furnished and erected by McClintic-Marshall Corp., G. P. Bullard manager of erection, and D. S. Shuman foreman on the job.

Skew Bascule Erection a Complicated Job

Span being erected in open position, floor beams and girders more than 100 ft. long had to be placed flat or inclined, requiring careful shoring and bracing

By Joseph H. Townsend
McClintic-Marshall Corp., Pottstown, Pa.

ERECTION of the skew-bascule span described in the previous article was unique in several particulars. Also, transportation of the long and heavy girders from the fabricating plant to the bridge site was a considerable problem. The span was erected in the open (85 deg.) position, so that traffic could be maintained in the canal, thus requiring the longest floor beams and girders to be placed flat, in which position they were flexible and difficult to handle. The heaviest load was the south bascule girder, which with the trunnion pin weighed 40 tons. All steel was set with a stiff-leg derrick, located on the bank of the canal and having a 90-ft. boom and a 15-ft. jib extension. The structural steel in the span aggregated 300 tons, and erection was completed in eighteen working days.

Fabricated steel was shipped by rail from the shop to Trenton and then hauled 6 miles by truck to the site. Special precautions had to be taken in hauling the east and west skew floor beams and the longitudinal girders, since these members were more than 100 ft. long and very shallow—6 ft. and 9½ ft., respectively. To haul them in a flat position would have required four 18-in. beams 85 ft. long as a support over the span of 70 ft. between the truck and trailer. They were therefore hauled in an upright position, using a combination of shoring and tierods, as shown in one of the accompanying illustrations.

The first erection operation was the setting and aligning of the two main trunnion bearings and the outboard trunnion bearing. The counterweight girders were assembled on the ground and then set in the pit and blocked to the proper elevation, so that no unnecessary maneuvering would be required in setting the two bascule girders. The south bascule girder, with trunnion pin previously driven, was placed on the bearing, framed to the counterweight girder and then shored and guyed. Erection of the north bascule girder followed, and the longitudinal girder LG4 (Fig. 1) was framed between the two bascule girders. Floor beam FB14 was also erected at this time. With LG4 anchored to the trunnion girder and braced by shoring, the steelwork was lowered to the closed-span position, where the bascule girders could be adjusted for correct alignment and all connections behind the two main trunnion pins driven. With this riveting complete, the bridge was raised to the open position again and securely shored and guyed.

Girder LG3 was then erected and the west-end skew girder SG1 was placed in position and shored at five intermediate points. This shoring rested on timber piles, used as fenders for the west abutment. Wedges and jacks kept this girder in a truly level position, so that no distortion would occur in the members subsequently erected. On girder SG1 the floor beams FB1 to FB7 were placed, together with their stringers and bracing, and capped by longitudinal girder LG1.

Tiebacks placed around the end of the south bascule girder held girder

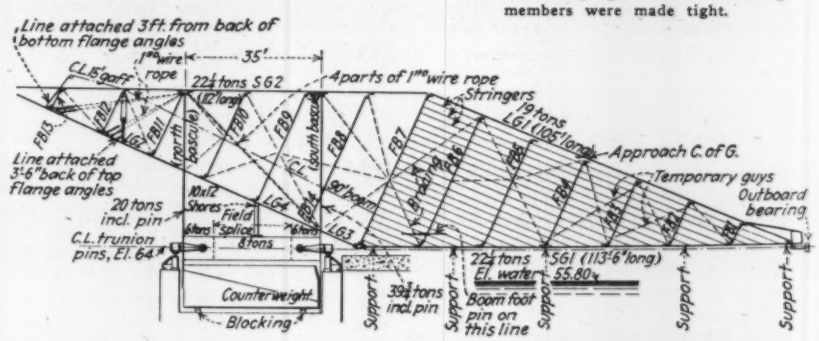


Fig. 1—Erection diagram for skew-bascule leaf, showing temporary guys and blocking required to prevent the framework from warping before all bracing members were made tight.

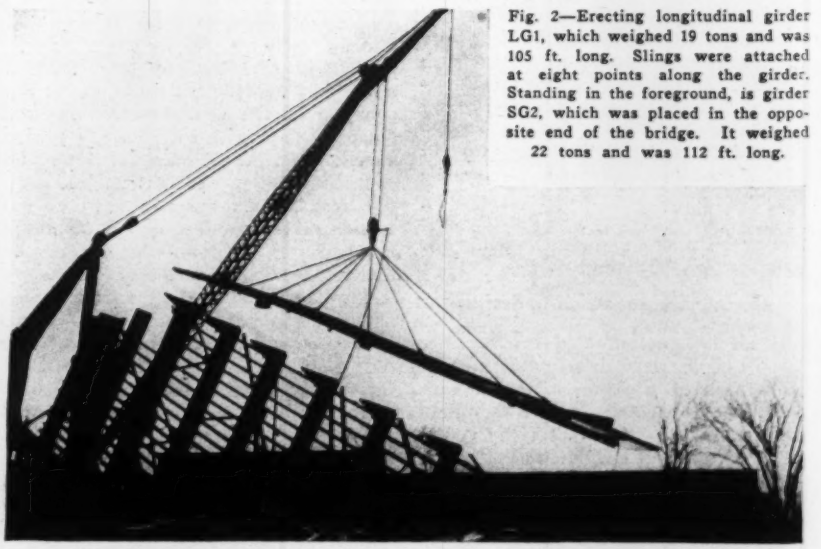


Fig. 2—Erecting longitudinal girder LG1, which weighed 19 tons and was 105 ft. long. Slings were attached at eight points along the girder. Standing in the foreground, is girder SG2, which was placed in the opposite end of the bridge. It weighed 22 tons and was 112 ft. long.

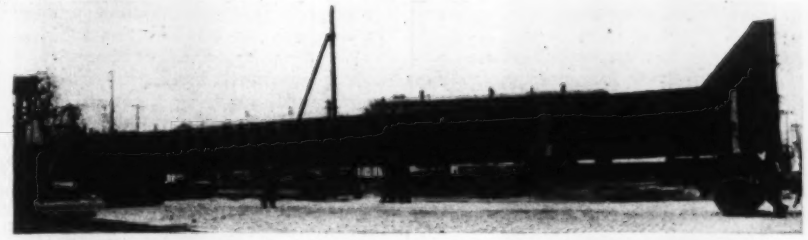


Fig. 3—The end floor beams and main longitudinal girders were more than 100 ft. long. They were fabricated complete at the shop and had to be trucked 6 miles from the railroad siding to the bridge site.

LG2 (Fig. 1) in position as it was being erected by the main falls and the jib line. The manner in which these falls were attached is shown in Fig. 1. The wire rope tiebacks were then adjusted, and floor beams FB8 to FB13 were erected, shored and guyed. The east-end skew girder SG2 was placed on these beams and bolted. Stringers and lateral bracing were erected to complete the span.

The bridge proved to be a very awkward structure to erect, the bascule girders being set on end, the skew-end floor beams being laid flat and all the other girders, floor beams and stringers being placed in a flat position but inclined with one end higher than the other.

After the counterweight forms and the temporary anchors were removed, the bascule span was lowered to the closed position and the live-load shoes were adjusted. The allowances that had been made for the warping and deflections of the leaf, due to dead loads, were found to be fairly close but not exact. The shoes were adjusted in height to conform to the actual shape of the bascule leaf, and the ends of the decks of the approach trestles were raised or lowered to line up with the deck of the bascule.

Highway Location by Aerial Maps

By H. L. Brightman
Engineer of Location, Michigan Highway Department, Lansing, Mich.

WHERE shall the new highway be put? To answer intelligently, it is necessary that an accurate study of the country, often of extended area, be made. It matters little whether the location be in the mountains, the plains, the sand dunes of Lake Michigan or the most densely populated land adjacent to or within the boundaries of metropolitan areas; the first and most imperative need for such a study is an accurate and complete map. This map should cover all possible territory within which the highway may be located so that its position with relation to industrial centers, centers of traffic origin, residential sections, feeder roads and traffic movements, cost of construction and right-of-way can be studied and a position chosen that will give the highway its correct relation to all those factors which call for its being.

The best maps available for highway location have been those made by the U. S. Geological Survey. They are admirable maps, but for this purpose they have fallen far short of the requirements. To supplement them with additional maps made by the usual ground methods of mapping is a slow and costly proceeding and the best of them are apt to be short of some particular feature which often is most important. We are therefore particularly indebted to our ex-army map makers for the contribution of their form of surveying to highway location—the aerial map.

While the aerial map is applicable to many different uses, only that of serving the highway engineer will be discussed. Foremost in importance are the scale of the picture. Lenses are made so that there is as little optical error as is possible, yet it is found that errors creep in and only the central half of the print will scale closely. To mount the prints in the mosaic form, only the central portions are used. For this reason liberal overlap must be made on all sides. The scale accuracy also depends on the closeness with which the plane flies to the predetermined elevation and on the flatness of the country. With good flying and ground no rougher than that of the State of Michigan, the errors are so small that it is unnecessary to make corrections by enlargement or reduction for use in highway location.

It has been found during about seven years' experience in this department that the scales most useful are: 1 in. equals 1,000 ft. for all country of an open, fairly level nature; 1 in. equals 800 ft. for well-settled and improved country, urban districts in large areas; 1 in. equals 400 and 200 ft. for closely built up urban districts and for close study of any particularly small area. The prints are not made originally to a larger scale than 1 in. equals 800 ft. because of extra cost for the larger scales and also because of the mechanical difficulties of photographing to the larger scales. These larger scales are obtained from the original negatives by the use of the enlarging camera.

By having the pictures taken with a two-thirds overlap a very useful optical principle, that of the stereoscope, allows a study of the pictures in the third dimension—height. Since the two sides of an object are photographed by succeeding pictures, by an arrangement of mirrors it is possible to view the prints as though the eyes were at the points in space the plane occupied when the two pictures were taken. Addition of suitable lenses enlarges the pictures at the same time. By means of the stereoscope a much more detailed study may be made of the prints and the engineer obtains a much more comprehensive knowledge of the ground.

The time of year has some bearing on the value of the resulting pictures. Those pictures taken when the leaves are off the trees are best for the detailed study of urban and suburban districts, as houses may be entirely hidden by foliage masses. Rural districts are often better delineated when the foliage masses are most marked. The altitude of the sun, making long or short shadows, also has a direct benefit in reading the prints. Shadows of an object more than half the object's height in length are likely to hide adjoining objects.

For the proper study of an aerial map it is necessary that a mosaic of the map be laid up from contact prints. The engineer should have such a map, a set of contact prints and a stereoscope. He should first study the mosaic until he has thoroughly mastered it, almost memorized it, so that the relation of the various items to one another is clearly established in his mind. A line should then be sketched on the map which will represent the proposed location. The detailed study should be made from the contact prints, using the stereoscope and plotting the line on the prints under the glass. By means of the vertical dimension it is easy to recognize objects which may be obscure on the mosaic and the line can be adjusted until it appears to fit all requirements. So far the entire study has been made in the office.

Following the office study a field check should be made. An accurate altimeter is of great assistance in checking elevations and sketching contours on the prints. Elaborate mechanical methods have been devised for locating contours on aerial maps but unless the country is very rough it is just as satisfactory to work without them. An engineer of experience and ability should be able to make a location from aerial photographs which is very close indeed to the final line that may be surveyed.

Transfer of the proposed line from the photographs to the ground is made by the usual methods of surveying, and complete data are then obtained for plans.

The cost of aerial surveys will vary in different localities. It has been found that their cost is very little compared with the cost of obtaining the necessary information by ground methods of surveying and that the results are much more complete and satisfactory. With such a map the engineer can feel that he has made use of all possible information relating to location and that his final result can stand on its merits against adverse criticism.

By reproduction by photography the mosaic map may be made into portable form by mounting on linen and can be used in a variety of ways. It may be enlarged and used as a property map for the purchase of right-of-way, the lines of the proposed roadway being marked on it and the boundaries shown of the property to be acquired. The aerial map allows a highway to be located and property acquired without the necessity of staking the location, should such a procedure be necessary.

This department has made very good use of aerial maps in the past in the location of highways through the dunes along the shore of Lake Michigan and in studying the location of belt lines and through routes for some of the larger cities of the state. It is likely that no important or difficult location will be worked out without their aid in the future.

Dragline Excavator Development for Levee Building

Increased boom reach, larger buckets, quicker swing and greater freedom of travel have enlarged working range—New power units have simplified servicing

By J. C. French
Bucyrus-Erie Co., South Milwaukee, Wis.

THE heavy-duty dragline excavator has been used since 1912 for levee building on the Mississippi River. Until the beginning in 1928 of work on the present flood-control project, calling for much larger levees, its development for levee work progressed with its development for general earth moving. In the last four years a profound change has occurred. The improvements in dragline excavators and their operation have been inspired primarily by the requirements for levee construction. Today this excavator is distinctively a special machine for throwing up long lines of levee embankment of large section as well as a machine for general earth moving. It is as a levee-building machine that the dragline excavator is considered here, but the deductions apply generally to heavy-duty draglines for all purposes.

The main points considered are power-plant practice, bucket practice, practice in mobile mounting, schemes of operation and versatility for different tasks. The mechanics and structure of the excavator are only briefly considered. In parts and particularly in the part on schemes of operation, schematic diagrams are substituted for descriptive text to condense information.

Excavating elements

Early dragline excavators were operated by steam, and many steam-powered machines are still in use. The most modern machines rarely have steam power. Despite its acknowledged advantages in cushioning digging shocks and quick pickup of power with increased load, steam power has well-recognized disadvantages. Fuel costs are large due to difficulties of delivery. Good water is hard to get and bad water causes excessive boiler trouble and maintenance. The operating and servicing crew is large. It is estimated that maintenance delays inseparable from steam power amount to 10 per cent of the working time. Remedy had to await some better means of power, and this has arrived only in the last few years with the development of practicable diesel power units.

The standard power unit of the modern dragline is the diesel engine. A variant is the diesel-electric unit. Straight electric operation is rare because of lack on the river of convenient sources of electric power. The diesel engine lacks the cushioning qualities and quick power pickup of the steam engine, but this deficiency is being met by electric and belt drives.

Bucket practice as developed on levee work differs from standard practice only in the use of lighter than ordinary construction. This is to get speed of handling and therefore volume of output rather than long bucket life. Generally the river digging is easy, and size of bucket is of greater advantage than extreme digging strength. A lighter bucket is of value also in allowing longer booms per unit of payload handled. Increased boom length, concurrently with lighter bucket construction, is a characteristic recent advance in levee dragline practice. By using lightweight aluminum-steel alloys boom lengths of 175 ft. and more are becoming frequent.

Traction development

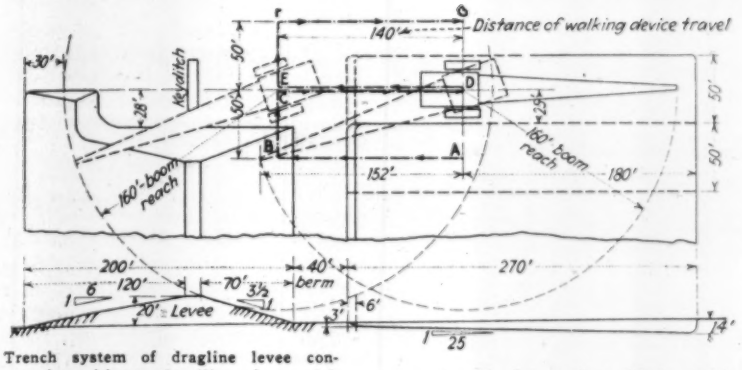
For levee work the traction is almost the most important mechanical element of the dragline excavator. The valley soils have little load-carrying capacity when wet or with groundwater close to the surface, and an important function of the dragline in levee work is freedom and safety of travel. Four methods of traction have been developed. These are: skid and roller, track and truck, crawler tractions and walking devices. Broadly, the steam-powered machines have skid and roller or track and truck traction; these are the older machines. The newer machines with diesel-belt or diesel-electric drives have either crawlers or walking devices. An appraisal of these tractions follows:

Skid and Roller Traction—The skid and roller traction mounting of the long-boom dragline consists of a series of wood rollers and skids, with a track planking. The travel movement of the machine is obtained by overhauling the dragline cable attached to the bucket, which is used as a deadman. The wood skids bear directly upon the lower structural framing of the machine, and the rollers are either of wood or of extra heavy pipe with wood cores and are placed at frequent intervals under the skids.

The track timbers and matting are constructed in sections and rest directly upon the ground, to be moved ahead as the machine progresses in its travel. These platform mats are skidded ahead by teams or by a tractor and are generally constructed to overlap and maintain a continuous path for the rollers.

The mats are items of continual expense and the rollers must be carefully watched and inspected to eliminate the danger of accidents. The ground must be leveled so that the mats bear evenly to avoid distortion and breakages. Maneuvering a machine mounted upon this traction device is a slow and tedious operation, and forward movement is generally a gradual process interlocked with a series of necessary delays. Extra man power is also a serious item of expense.

Present-day long-boom dragline practice on the river work indicates the passing of this antiquated traction device. The only advantageous feature



Trench system of dragline levee construction without rehandling of material.

is that the total weight of the machine is generally less than for any other type, owing to the absence of propelling machinery. For that reason levee construction can be maintained on extremely soft ground with roller traction.

Track and Truck Traction—The truck-mounted long-boom dragline excavator is provided with four four-wheel truck units, one at each corner, which support the machine through pedestals attached to the base members. These ride on rails, and the rails in turn rest upon timbers and mats. Some of these truck designs are arranged for a three-point suspension to eliminate twisting strains upon the truck frames and the base framing, while others have hydraulic-jack pedestal mechanisms, so that the machine can be leveled at each new setting, and the operation is maintained on a hydraulic-cushion bearing at each corner.

Most of the truck types are power driven from the machinery set, which is located upon the main revolving frame of the machine, but a few of the older types require overhauling of the dragline cable, using the bucket as a deadman. The track sections are required to be placed in a straight line to support the machine during regular operating periods, but short sections of track are inserted to allow turning the machine on a long radius, to gain other straight-line working positions. The machines of this type are not easily maneuvered when other than straight-line travel is required.

Owing to the difficulties in the control of travel direction other than straight-away, the truck-mounted dragline machine is definitely locked to certain work systems for operation. These systems are known as one line or parallel operating sequences and the machines are moved back and forth on successive lines of operation, so as gradually to move the earth from the borrowpits into the levee fill by a series of definite spoil placements, each requiring a new track setting. A long line of unfinished levee is left open for a considerable time.

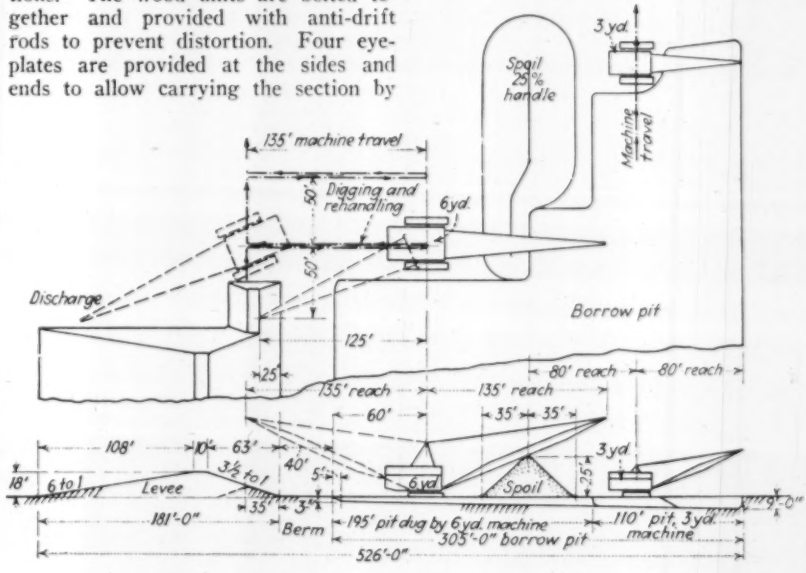
The track sections are generally built in 15-ft. lengths. The ties are 8x10 in. by 12 ft., spaced 20 in. apart, with nine in number for each 15-ft. section. The stringers are 12x15 in. by 15 ft., armored with ¾-in. plate 14 in. wide on which is carried the 100-lb. rail sections. The wood units are bolted together and provided with anti-drift rods to prevent distortion. Four eye-plates are provided at the sides and ends to allow carrying the section by the lifting bridle, when the sections are swung around and into position ahead.

Moving up the track sections generally requires a large ground crew and from 1½ to 2 hours daily. If the ground is soft, 3x13-in. by 15-ft. planks are laid for a base.

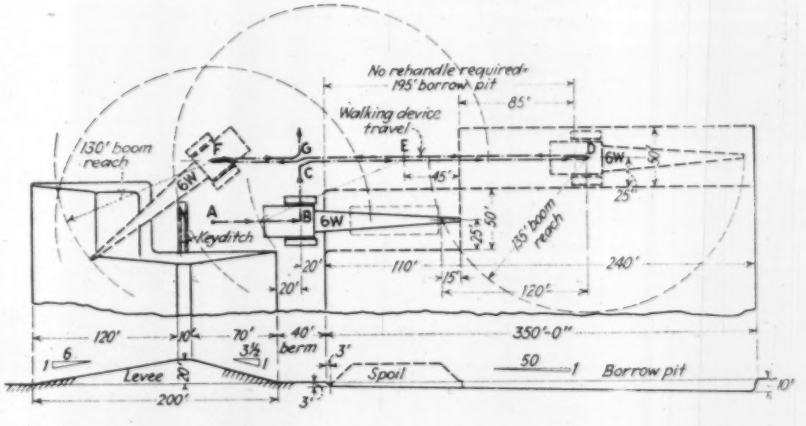
These planks are not made a part of the track section generally, as the ground suction in soft materials establishes a difficult lifting resistance and the suction-breaking lift is severe upon the dragline machine. The planks are usually lifted separately by man power with the aid of bars, after the track sections have been lifted off and swung forward by the machine. The planks are then carried ahead singly by man power or by a tractor and again placed in the proper position. Using planking during the difficult working months requires additional man power and also increases the delay time of the move-up operation.

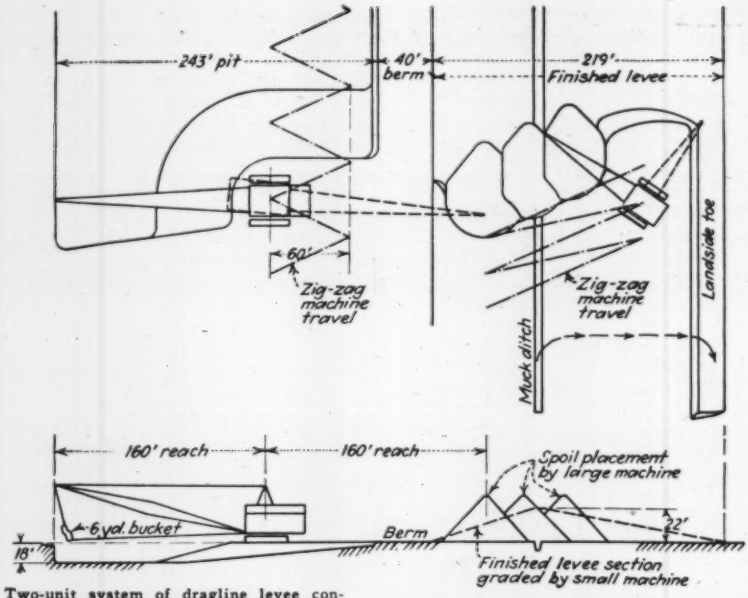
Crawler Traction — The crawler-mounted machines are carried upon four trucks, one at each corner. Two of the trucks on one side carry the load from the base through rigid pedestals and the two on the opposite side carry the load from the base through a heavy equalizing beam having a bearing at its center and jackscrews at each end. These jackscrews are set against the base corners to support them rigidly when digging. When moving the machine the jackscrews are released and a three-point bearing support is provided for the load. Each truck has two tread belts.

Two-machine method of dragline levee construction with minimum rehandling.



Checkerboard system of dragline levee construction with 50 per cent rehandle.





Two-unit system of dragline levee construction with single handling.

The machine is turned by driving the two trucks on one side at one speed and the two trucks on the other side at another speed. By this means the machine can be turned on a short radius.

The distribution of weight by the crawlers brings the actual bearing pressure down to a figure which will allow operation on firm and hard ground, but on soft ground it is necessary to use mats.

Operation on mats, however, is accomplished by crawlers without the delays and time losses which are interlocked with the track sections of the truck-mounted machines, and a working system has been adopted which allows completion of the levee line in shorter work sections than those required by the truck-mounted types. This system consists of operating the machine zigzag back and forth toward and away from the levee and parallel to the levee. This in and out angle movement completes the levee station by station.

Walking Traction — Long boom dragline machines, mounted upon the walking device, are not interlocked to any definite working system, owing to the flexibility of the traction mounting. The machine consists of an upper or revolving frame, which mounts the dragline machinery set and the diesel engine driving machinery, which is centrally positioned upon a circular base. This circular base rests directly upon the ground and it is dimensioned to give a large bearing area. The machine revolves upon this base when in operation excavating, slewing and spoiling.

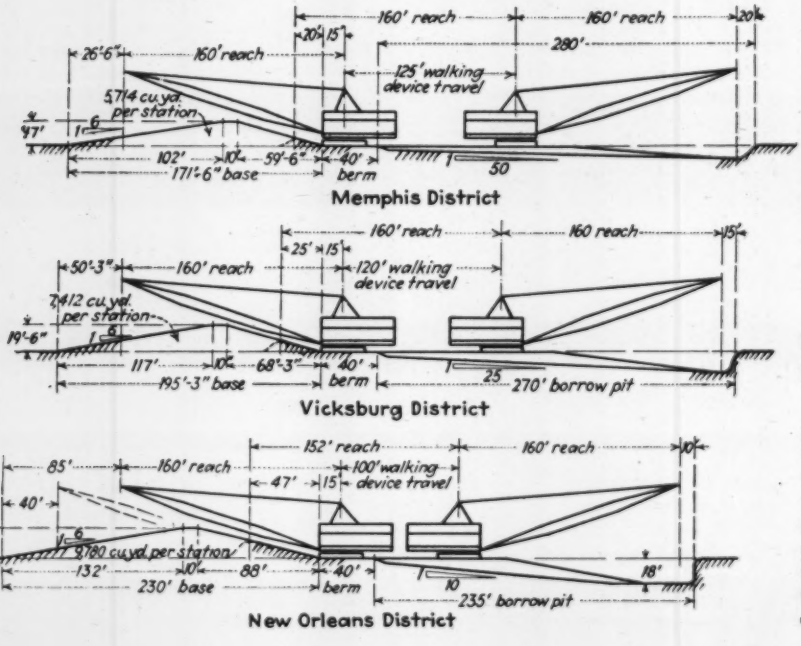
The direction control of the walking movement is obtained by swinging the upper or revolving frame upon which the walking shoes are supported into the direction in which travel is required. Unlimited direction control is thus obtained and sidestepping, zigzagging and circling movements are all well within range.

The machine operates upon extremely soft ground without matting or timbering, as the minimum bearing pressure is maintained at 7 lb. per sq.in. This low pressure is standard for all sizes, so that the largest machines can negotiate the same ground as the smaller. The completion of levee sections, station by station, is definitely allowed by this type of machine, as it operates equally well at right angles or parallel to the levee line.

The general tendency of design of dragline excavators is toward the speeding up of all functions. Quick loading of the bucket, quick hoisting and swinging are all recent developments in the newer models installed recently upon the river work. The average combination of all of the cycles is timed to allow at least a full swing of 360 deg. with a loaded bucket for the 180-deg. cycle in one minute or even less. This cycle is maintained on even the larger 8- and 10-yd. machines with 175-ft. booms which are being placed in commission on the work. In particular, traction speed has been greatly increased as described.

These speeding up developments give the dragline versatility in performing many odd tasks of levee work. In particular the mobility of the new machines to step out of the normal operating line to obtain extra yardages is a striking improvement. Such extra yardages are called for where section corrections are required, where angle levees or tie-in levees have to be built, where soft material, as in slough bottoms, has to be removed before the levee fill is placed, where depressions or sharp slopes in the borrowpit area cut down normal pit yardages, or where a slide or subsidence occurs.

Maximum yardage of levee that can be built without rehandling in each river district.



Sectional Meeting of World Power Conference

A sectional meeting of the World Power Conference is to be held in Stockholm from June 26 to July 10, 1933, according to an announcement in *The Engineer* (London). The program is to be concentrated on the energy problems of large-scale industry and of transport, attention being directed toward fundamental engineering and economic problems.

Porous Light-Weight Concrete for Long-Span Floors

In nine-story steel-frame apartment at Fleetwood, N. Y., panels up to 3x19.80 ft. were designed on laboratory tests that showed a deflection of 1:360 under a load of 316 lb. per square foot—Special concrete poured to depth of 3½ in. rose to 7½ in. in setting, giving it its porous characteristics

By A. G. Hillberg
Consulting Engineer, New York City

ACTIVITY in light-weight floor development is by no means confined to the interesting steel designs that are much in evidence at the present time. Novel uses of cast and poured gypsum floors continually increase in number. New York and some few other cities have long taken advantage of light-weight cinders as concrete aggregate. Prepared burned shale under the trade name of Haydite has been used extensively in the United States and Canada both in poured and block concrete floors. A building using a concrete material, known as Porete, in which lightness is achieved by adding a special foam compound to the mix was described in these pages recently. The following article describes a unique floor design, using another special material, Aerocrete, a porous concrete formed by adding an alumina compound to the mix, which acts upon it in much the same manner as yeast acts upon bread dough, the amount of rise during setting depending upon the density of the mix. It has been used as floor fill in such structures as the Northwestern Bank Building, Minneapolis, the Board of Trade Building, Chicago, the Cleveland Terminal Buildings, Cleveland, the Aetna Life Building, Hartford, and the Royal Bank of Canada, Montreal, and as a structural floor material in the Bethlehem Steel Building, Bethlehem, Pa., the Y.M.C.A. Building, New Haven, and the Eastman Building, Rochester. To these are now added the long-span construction of the Fleetwood Apartments, described in the following article. The author states that, while he had no connection with the job described, he is using similar construction for all of his own work and is achieving a saving of about 20 per cent in steel tonnage by virtue of the light floor weight. —EDITOR.

LONG-SPAN shallow-depth floor construction is often desirable, and from time to time new types of construction are advanced. Recently a fireproof apartment house, known as Grand Gardens Apartments, was completed at Fleetwood, N. Y., which included a novel floor of this type. Not only is the design of interest, but the tests on a model panel before the execution of the job and an actual field test of a panel in the completed building have brought out much of interest. Briefly, the design of the floor system is based on full continuous action over multiple supports of small I-beam joists spaced from 2 to 3½ ft. apart and filled in with a light-weight special concrete reinforced with wire mesh.

Test data

The designers of the job had available the log of a test conducted in 1930 by the testing laboratories of Columbia University. Fig. 1 shows the layout of this test panel and the provisions made at the supports to insure the same condition of action as for an inner span in continuous-slab construction. Self-furring metal lath was wired to the lower flanges of the 6-in. I-beams and covered with ½ in. of gypsum plaster so placed that the finished surface was 1½ in. below the bottom flanges of the beams. The spaces between the beams and a distance 2 in. outside the outer beams were filled with "aerocrete," a light concrete material, the weight of which can be regulated at from 30 to 60 lb. per cubic foot. In this case 35-lb. material was used. The fill was poured in a layer 3½ in. thick and was allowed to rise to the level of the top flanges of the 6-in. I-beams, or a total of 4 in. The panel was finally finished off by a 2-in. cinder-concrete fill of dry consistency, tamped into place. Ten days later the test was run by applying a load of pig iron in increments of 7,500 lb. until failure occurred. Deflections at the center of the span were read by means of a wye-level. Under the maximum load of 87,333 lb., equivalent to 553 lb. per sq.ft. of floor area, the deflection of the floor gradually increased until it settled down upon the supporting I-beams. There was no pronounced local failure, and the floor had reached its full carrying capacity both at the supports and at the center of the span. In practice a deflection of 1:360 is permissible, corresponding to a deflection on a 24-ft. span of 0.8 inches. The table indicates that at such a deflection the test panel carried 316 lb. per sq.ft.

On the basis of this test and using the usual moment coefficients for continuous-beam or slab construction, the design for the floor system of the nine-story apartment house at Fleetwood was developed. As is shown in Fig. 2, the spacing of the I-beam joists varied from 2 ft. 10 in. to 3 ft. 6 in., the spans from 12 ft. 3 in. up to 19 ft. 9½ in., and 5-in. I-beams were used except for the longest spans where 6-in. I-beams were required. The joists were coped between the girders, and continuity of action was insured by the design shown in detail.

Wood forms were suspended from the joists, and the girders were boxed in the usual fashion. Welded wire mesh, 4x12 in., was placed transversely to the joists, and the aerocrete was poured and allowed to rise, in this instance 3½ in. The weight selected was 45 lb. per cu.ft. for a 7½-in. thick-

LOG OF TEST OF LIGHT-WEIGHT CONCRETE PANELS

24-ft. span. Width of panel, 6 ft. 7 in.
Total thickness of slab. 9½ in. Area of floor panel, 158 sq.ft

Applied Load, Lb. Per Square Foot, Total	Center Deflection, In.
0	0.0
11,603	0.09
28,400*	0.36
40,000*	0.57
50,000*	0.80
64,150	1.04
66,411	1.16†
74,049	1.42
81,553	1.86
86,293	2.44
87,333	2.66

* These loads are approximate only.
† Hair cracks, bottom of east support.

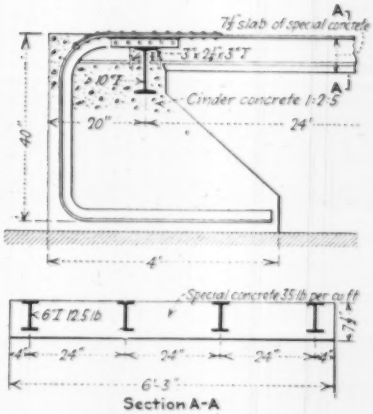
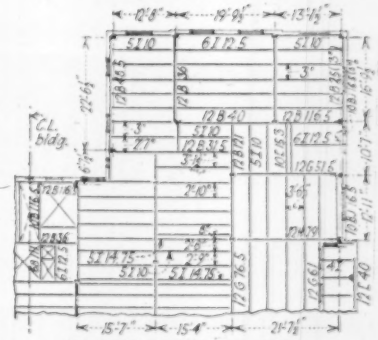


Fig. 1—Test panel layout in which special provision was made at the support to simulate action of an inner span in continuous span construction.



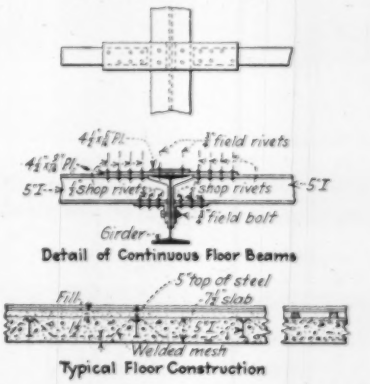


Fig. 2—Typical long-span floor layout with detail showing method used to secure continuity in the floor beams.

ness. The floor system was topped by a 2-in. aerocrete fill with ⅞-in. underflooring on wood sleepers laid in the fill.

For the field test the longest span of 19 ft. 9½ in. was selected, having 6-in. 12.5-lb. I-beam joists spaced 3 ft. on centers. A strip 6 ft. wide was uniformly loaded with cement bags to 36 lb. per sq.ft., and the deflection was found to be ⅝ in. The load was then increased to 60 lb. per sq.ft., or 1½ times the figured live load, and the resulting deflection was noted to be ⅞ in., or 1:1900. The permissible deflection of 1:360 would have been 0.66 in., or about ⅝ in. After removal of the load the floor construction returned to its original position. The test also showed the floor system to be stiff and free from vibration.

This floor system has been developed by the Aerocrete Corporation of America, of which K. P. Billner is vice-president and general manager. The designing and supervising engineers of the Fleetwood building were the Gunwald Aus Co., with A. S. Schoyen in charge of the field tests.

Mass-Production Economies Sought for Small-House Construction

Majority of speakers at meeting sponsored by American Institute of Steel Construction in New York favor shop fabrication and field assembly and report some efforts in this direction

AT THE small-house forum held in New York May 24 and 25 under the auspices of the American Institute of Steel Construction, engineers and architects discussed the progress and possibilities in providing better houses at lower cost. Although steel was the material given most consideration, many other materials entered the discussion. Fred T. Llewellyn (U. S. Steel Corp.) clearly stated the case for steel in remarking that its use depends upon the proper use of many other materials and that it is not primarily the strength characteristic of steel that makes it good residence material but rather its ease of fabrication and erection and its ability to serve as a skeleton on which to hang materials. The hope for better and cheaper houses was believed by the majority of the speakers to rest in the ability to produce and sell them as automobiles are produced and sold.

Harvey Wiley Corbett, architect, New York, envisioned the complete factory-built house purchased complete and capable of being enlarged by purchasing extra rooms and of being moved with the furniture when the family moves. He mentioned two possible types: steel-frame with fill-in panels, and stiffened panels alone without a frame. We have become a nomadic people, said Mr. Corbett, and the old homestead idea is dead. Housing must be standardized just as automobiles have been standardized. Small-house architects should realize that this method of building is coming and should start now to adjust their activities to it, said Mr. Corbett. Eli Jacques Kahn, architect, New York, also urged factory production of houses and pointed out that our manner of laying out a house interior is archaic and requires elimination of many useless corridors and rooms.

Construction of a frameless steel house will start next week in Cleveland, according to Bennett Chappel (American Rolling Mill Co.). The house was described by Mills G. Clark, the builder, as having walls, floors and roof of 18-gage steel sheets formed with box-like corrugations and coming to the job in units ready for assembly. The wall corrugations will be filled with rock wool, held in position by insulating boards. The exterior will be faced with an asbestos tile. The floor units will be welded together to form a series of boxes each 6 in. deep by 10 in. wide. Floor and walls are connected by bent plates. Windows come complete in full-story heights. Other materials are fastened to the steel plates by special adhesives. The entire structure will be welded. Mr. Chappel also told of a vitreous enameled steel-sheet house planned for Cleveland, and another to be built at the Chicago Worlds Fair and planned to cost less than $5,000.

Market for steel houses

A committee of the U. S. Steel Corp. has been studying the problem of the steel-frame house, and J. C. Shields, assistant general sales manager, outlined the results. A potential market of 3,600,000 tons annually is available (assuming 300,000 new six-room houses per year) made up of 2,250,000 tons of shapes in the frame and 1,350,000 tons of sheet and strip in walls, floors, etc. A total of 56 systems of construction using steel have been tried, some contemplating mass production, others adapted to individual design and construction, according to the survey. The value of steel in a house amounts to only 8 to 10 per cent of the total cost. Mr. Shields concluded that steel makers should do everything possible to promote the steel house but should not invade the builder's field by selling a complete structure or sponsoring any specific type of construction.

Financing

Until financing costs are reduced, low-cost houses are almost impossible. Arthur C. Holden, architect, New York, pointed out that the small house needs a better economic structure as well as a better physical one. P. E. Selby, whose company, Steel-Built Homes, Inc., Cleveland, sells a shop-fabricated product, urged the necessity for construction that has long life and small maintenance costs. Mortgage companies favor shoddy construction by loaning on a cubic-foot or square-foot basis, said Lee H. Miller, chief engineer, American Institute of Steel Construction. Robert Tappan, architect, New York, also spoke of how housing was burdened by bad financing and urged the elimination of the second mortgage. If good small houses are really to be sold at low cost, they must be merchandised just as automobiles are, he said.

G. H. Danforth, who described the extensive use to which Jones & Laughlin junior beams have been put in small-house construction, stated that the insurance companies do not interest themselves in better houses because house insurance premiums are so small that it is not economical to check and rate each house according to its good construction qualities. Harold P. Mueller, builder, Philadelphia, described a group of six-room homes he has recently built, junior beams and concrete being used for the first floor, and solid brick walls and wood for the second floor, to sell for less than $6,500, including land. The fireproof first floor cost 19c. per square foot, and the wood floor cost about 12c.

Three other speakers touched upon the mass-production phase of the question. Henry Dubin, architect, Chicago, described his own steel-frame house in which battledeck steel floors were brought to the job in panels as large as 10x12 ft., lifted directly into place and welded to the columns. D. E. McEvoy, builder, New York City, showed a moving picture of his factory developed to produce houses during the Florida boom and since closed, but forcibly illustrating how shop assembly of houses can be as rapid and efficient as automobile assembly. T. J. Foster, National Bridge Works, New York, and a pioneer in promoting shop production of small houses, described his system in using a steel frame, shop-manufactured wall and roof slabs of aerated gypsum about 4x10 ft. size, and shop-manufactured forms for the concrete floors. Mr. Foster pointed out that the need for fireproofing residence steel does not exist, since fires in houses never produce a temperature as high as 1,000 deg. F. Mr. Foster's ideas for the small house were treated in detail in a series of articles in *Engineering News-Record*, beginning Jan. 16, 1930.

Preventing Sand Drifts on Highways

Methods of checking sand drift formation by fences, planting, spraying and blanketing, including examples from railway practice

HIGHWAYS across desert and dune sand areas and along sand beaches have a special maintenance problem in keeping the travel surface clear of drifting sand. The difficulty is intensified where blow sand is encountered. A survey of practice in preventing sand drifts has disclosed a number of preventive devices that have been employed with success. Some of these are from railway practice which encounters the same problems as does highway practice and whose solutions appear equally applicable to highway requirements. Generally speaking, the types of devices designed to prevent the sand from blowing appear to be more permanently effective than do those that act as drift stops.

—EDITOR.

DRIFTING SAND, as a trouble on both railways and highways in certain sections of the country, is checked mainly in three ways: (1) by fences on the principle of snow fences, to check the wind and so cause the sand to be deposited on the windward side of the fence; (2) by spreading oil or brush on the sand surface to consolidate it and protect it from the wind; (3) by raising the grade above the general surface of the ground so that the sand will blow across the road or railway and not collect in drifts. Two views of sand drifts and sand fences on the Nebraska state highways are shown in Figs. 1 and 2. In Texas this problem is being faced by the highway engineers on account of the construction of new roads through sandy districts in the northwest section of the state.

In any one district all these methods may be used as alternatives or to meet different conditions, although the third is applicable mainly to highways. In California, for example, three conditions are encountered by the state division of highways:

1. Sand dunes of considerable height, where the movement is comparatively slow, usually in desert areas where lack of moisture precludes planting to secure stability. Here, if possible, a trench is cut in the dune in the direction of the prevailing wind, which facilitates the movement of the dune over and across the highway.

2. Long flat stretches of a broad expanse of sand swept by wind. This also is a desert condition and is handled by the installation of snow fences set back from the highway.

3. Beach dunes continuously replenished by the ocean. Here planting is attempted to retard progress of the sand, and every effort is made to eliminate abrupt breaks in the slopes of the roadway, which might check the velocity of the wind and so prevent it from sweeping the sand across the highway. As to sand dune conditions in California, the following is an abstract from a statement by C. S. Pape, chief construction engineer of the division of highways, in the *Proceedings*, Am.Soc. C.E., November, 1931, p. 1,341:

In a number of places this division has been faced with the problem of control or elimination of sand dunes, which have been not only a serious burden on maintenance but also dangerous to traffic. It is quite usual for a sand storm to place a dune several feet in depth across a highway in a few hours. A study of dunes and their movements demonstrated that they could be conquered. In many localities most of the dunes were found to move in a certain direction and then attain a height which was seldom exceeded. By the construction of a high-grade line over the worst section of dunes, dangerous drifting was entirely eliminated and the road was clear at all times thereafter. In other locations, dunes could be removed by wind action by cutting channels at suitable positions and at very low expense.

Sand fences

Some railways use their standard snow fencing for sand protection. Sometimes these are fixed fences with boards vertical and close together, but more generally they are portable fences having horizontal boards in panels that are supported by struts or back legs hinged to the posts. Another form of fence used for both sand and snow protection on railways and highways consists of wood lath or slats 1½x½ in., spaced 2 in. apart and woven into five lines of two-wire cables. The slats are about 4 ft. high and 6 to 12 in. clear of the ground. This fencing is shipped in rolls and may be attached to the existing fence posts or to temporary posts set back from the property line. The Union Pacific Railroad has used this type of fence (Fig. 3) in desert country, with two or more lines about 150 ft. apart, the first line 150 ft. from the right of way. When sand has filled to full height, the fence is pulled up and reset on top of the drift, usually a short distance farther back. Where deep drifts occur along the Columbia River, this road has used tight board fences 8 or 10 ft. high (*ENR*, March 6, 1924, p. 414). In some cases these are more effective if the lower boards are omitted, thus causing a funnel or blast effect by which the wind will carry the sand across the track, to be deposited at a lower level.

On highways in the Cape Cod district of Massachusetts, sand fences of 6-in. boards placed horizontally and 2 in. apart are found to be more effective than vertical boards or slats, but covering the surface of the sand is considered generally more effective than fencing. Railways have sometimes used solid fences or bulkheads of old ties partly on open line, but more often for protecting switches and turnouts.

A special sand fence used on highways in Nebraska, Nevada and Utah, and also by some railways, consists of three lines of barbed wire to which brush is attached in two courses, as shown in Fig. 4. The first course of

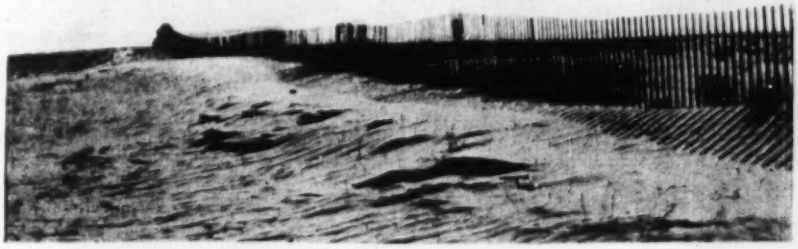


Fig. 1—Sand fence along a Nebraska highway. Four-ft. slat fence is parallel with and 100 ft. from center line of road.

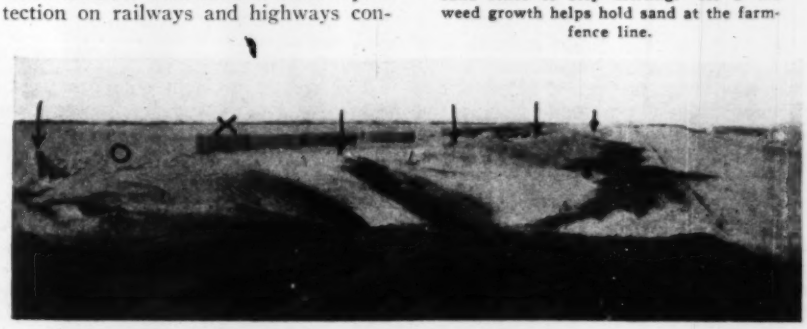


Fig. 2—Sand drift on a Nebraska road. Arrows indicate tops of posts of 4-ft. three-wire farm fence. At X is a new sand fence to stop drifting. At O the weed growth helps hold sand at the farm-fence line.

brush has the stems strung on the bottom wire, 18 in. above the ground, the tips resting on the ground and being covered with sand to hold the brush in place. The other wires are 12 in. apart, and the upper course of brush is strung on the top wire, hanging low enough to overlap the bottom course. Wood posts are 6 to 16 ft. apart. However, covering the sand surface is considered preferable in Nebraska and Nevada, as it is in Massachusetts.

The difficulty with all fences for sand is that the drifts thus caused may remain or shift or build up indefinitely under prevailing winds, while snow drifts disappear with the return of warm weather.

Covering the sand

Covering the sand to prevent drifting, instead of stopping it while drifting, is employed more extensively than fencing and is generally considered more effective. In Nebraska the highways are protected from sand mainly by controlling its movement by spreading hay, straw and manure on the slopes and ditches, and also at blowouts where sand drifts across the road. With seed sown in this covering, a growth can be started that usually makes a permanent sod before the covering decays. Rye, sweet clover and other grasses are sown, while many weeds spring up and help to make a heavy growth. Planting sagebrush proved a success on a railway across the Sinai desert, Palestine (*ENR*, Feb. 2, 1922, p. 206).

In the sandy Cape Cod district of Massachusetts, where snow fences have not been satisfactory as sand protection, good results have been obtained by spreading coarse brush, with limbs not exceeding 1½ in. in diameter, over the drifting section and a little beyond it. This brush will last for several years and has a tendency to level the sand in such a way that the drifting stops before the brush decays. A modification of this practice, for locations where it is difficult to hold brush in place, consists in fastening short cedar trees and other brush to timbers or deadmen that are buried about 1 ft. deep, the trees or brush extending about 2 ft. above the surface. If the sand builds up, the barrier can be raised and replaced.

In Michigan there are two general conditions where the threat of drifting sand occurs. The first and most common is where a road passes through old sand dunes or sand plains covered with tree growth or other vegetation. When cuts are made through wooded dunes the wind has an opportunity to blow the exposed sand, so that protection is necessary to hold the grade and back slopes. In such cases the back slopes and the steeper fill slopes are sodded, and the shoulders and flatter slopes of the fill are covered with top soil, clay or other material that will not drift. Where the only material available is peat or muck, a layer 3 to 4 in. thick is applied and mixed with the surface sand by harrowing. This mixture generally is stable enough to hold the grade until a growth of grass or other vegetation gets established, when there is no more trouble.

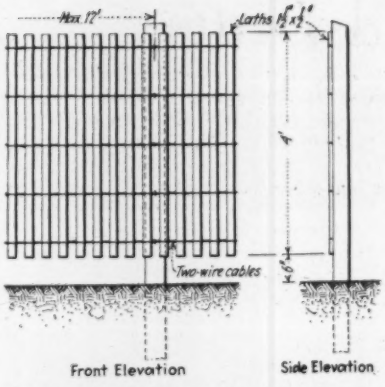


Fig. 3—Union Pacific Railway uses portable slat fences of the construction shown to check sand and snow drifts.

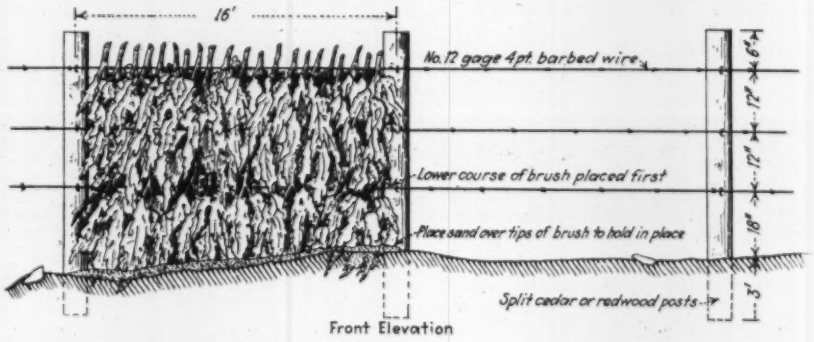


Fig. 4—Brush and wire fence for drifting sand, as used on Nevada and Utah state roads.

A more serious but less common condition occurs where the road passes through an area of barren sand dunes or sand waste with little or no vegetation, especially along the shores of the Great Lakes. In such places the sand blows in from the lake and tends to bury the road; or if the road grade is high, it tends to erode the road grade. On high fills the slopes can be protected by sod or any other material that will not drift. Where the land is fairly level, the grade is laid somewhat above the general ground surface, with easy slopes, while the shoulders and slopes are covered with material that will not drift. The sand drifting in from the sides then tends to blow over the road rather than to remain on the surface.

The greater problem occurs in cuts, where the tendency is for the sand to accumulate. As sand drifts in a manner similar to snow, it can be controlled more or less successfully by building windbreaks, erecting ordinary snow fences or by planting trees, beach grasses or other vegetation to prevent drifting. In spite of all precautions it is necessary in some cases to remove drifted sand from the roadway by ordinary excavation methods. For this reason it is found desirable in Michigan to provide hard-surface roads through areas threatened by drifting sand.

Oil spraying is probably the method most widely used, the purpose being to form a mat or coating of sandy oil that will not be picked up or broken by the wind. In Nevada light applications of fuel oil along the shoulders of the highways and on the surfaces of the sand dunes have proved satisfactory, so that the use of fences has been practically discontinued. In California, also, fencing has in general given way to the oiling method. When a sand dune begins to encroach on an oiled area the highway department has it loosened or broken up by a tractor-hauled cultivator, so that the wind can move the sand across the road quickly instead of by the slow motion of a solid dune.

On desert sections of the Union Pacific System the spraying of oil for some distance from the track has been found very effective, even with the blow sand, which is much lighter and finer than the ordinary desert sand. The surface is first carefully smoothed and leveled with scrapers and shovels, sometimes as far as 800 ft. from the track. Then fuel oil is sprayed from a 1½-in. hose fitted with flat brass nozzles. This work is done by the aid of a work train with tank cars and a car equipped with a pump and pressure tank to which the hose lines are connected. The roadbed is also oiled to prevent dust being raised by passing trains, but this is done by a car fitted with perforated pipes that are hung across the track and may be extended to reach 9 ft. beyond the ends of the ties. This is similar to the oiling practice on several roads using gravel ballast, the main purpose being to eliminate dust on passenger trains.

Elimination of sand troubles by raising the grade of highways above the ground level has been found successful in California, as already noted. In New Mexico this is the usual method of sand control, as the sand is then blown across and clear of the road. It is considered there that any kind of fence would tend to cause rather than prevent sand drifts. However, the ditches require frequent clearing, as they intercept and collect the drifting sand.

Letters to the Editor

Public Works During a Depression

Sir—The press reports of the answer of President Hoover to the president of the American Society of Civil Engineers in connection with a proposed program of public works have been reviewed with interest.

In attempting to analyze the question as to the method to be used in the expenditure of government funds so as to produce a maximum result to a maximum number, we are certainly confronted with a complex problem when we consider the range of territory covered from a direct dole to a self-sustaining project.

It would seem to me that the ultimate aim of any legislation for relief would be not merely to sustain the individual during the period of construction activity but also to expend these funds so that, in addition to this phase, there would be a tendency to create a situation whereby it would be possible for more individuals to make themselves self-sustaining. The question then arises: can this be done only by direct means or can it be done indirectly? In other words, is it not possible in many cases to produce a result more far-reaching in the construction of public works, which in themselves are not self-sustaining, than in using these funds solely for self-sustaining industry?

To me it would seem that the argument of "log-rolling process, which will include dredging of mud creeks, building of unwarranted post offices, unprofitable irrigation projects, duplicate highways and a score of other unjustifiable activities" can certainly be applied with greater force to the financing of private industry by governmental funds, the entire matter being a question of the character of the men in charge of the allocation of these funds. If such a splendid organization as the R.F.C. were to handle these funds, there would be no such condition of log-rolling.

The ability of the public to analyze more accurately the merits or demerits of public projects rather than private projects would produce a healthier atmosphere.

In the reply, reference is made to the character of the work to be done by one of the railroads in the electrification of its line with funds from the R.F.C. This undoubtedly was a splendid loan. It will produce greater operating efficiency, it will provide much work during the installation, and the loan will be repaid the government. On the other hand, after the work has been completed, will not this very increased operating efficiency mean more unemployment, unless it can be argued that this increased efficiency will produce sufficient additional business to offset the direct labor diminution? I would not for one instant suggest that mechanical progress should be stifled, but I do think that in the financing of projects for relief we must consider not only the development of efficiency in industry so that industry may survive, but we must also consider the development of projects that bring into use natural resources of communities that are not now being utilized as they should be, in order to create more work for labor. This requires in many cases the use of federal government funds in the construction of roads, bridges, tunnels, etc.

Such expenditures may not be directly self-sustaining. However, if these projects are selected with care, I think it can be said that they are indirectly self-sustaining, in that the benefits received are greater than the assessments.

It has often been stated that we could lessen the severity of our depressions if public works were so planned as to be undertaken when industrial conditions were at a low ebb, and it would seem that now is the opportune time to start such a policy even if the mortgage has to be increased.

J. B. CONVERSE,
President, J. B. Converse & Co., Engineers.

Port Arthur, Tex.,
May 23, 1932.

Backfilling Service Trenches

Sir—I have read with interest the article appearing in *Engineering News-Record*, April 14, 1932, p. 558, reprinting a part of the paper presented by F. D. Woodruff, assistant superintendent of maintenance, New Jersey highway commission, before the Association of Highway Officials of the North Atlantic States.

May I call your attention to a method of supplementing the care with which this type of work is carried out as described by Mr. Woodruff? Irrespective of how carefully the backfill over a utility pipe is replaced, there is no question that it will not be possible to get the material to the same general compaction as the material on each side of the trench. Further, no matter how carefully the backfill is tamped into place, it is probable that the edges of the trench have been weakened as the excavation was carried out, so that there will be a considerable amount of looseness in the subgrade under the pavement back for perhaps 1 to 2 ft. on each side of the trench. It is quite impossible to bring this to a uniform condition either by tamping or by jetting, and backfilling with gravel and sand does not meet the condition entirely.

The different characteristics of the backfill allow for the passage of water through this section of the subgrade differently than through the remainder, and eventually there will be settlement. A method has been developed that will eliminate this settlement by replacing the earth as it compacts below the slab. I refer to the use of the mud jack.

It is entirely feasible to drill holes in the pavement about 2½ in. in diameter and spaced from 6 to 10 ft. apart, through which mud (mixed with a small amount of cement) can be pumped. The availability of this method does not mean that backfilling should not be carefully carried out, for naturally it is cheaper to backfill with care than to force mud through a 2½-in. hose. But it eliminates the time element in waiting for the fill to settle.

The cost of pavement justifies real consideration on the part of cities, counties, states and utility officials in meeting this ever-present problem of settlement over service lines. The speed of present-day traffic demands that the surface of the road be kept uniform in order to eliminate possible danger.

K. H. TALBOT,
Director of Research,
National Equipment Corp.

Milwaukee, Wis.,
May 15, 1932

Beam Ends—Fixed or Free?

Sir—The discussion regarding windbracing and the efficiency of windbracing connections has broken out anew. (See *Proceedings*, Am.Soc.C.E., February, 1932, and following issues.) One point, and that an important one, is seldom touched upon: Should the connections of transverse girders to columns be figured as rigid? They are so assumed in designing the windbracing, while in proportioning for floor loads the girders are usually considered simply supported at the ends. Is this consistent? Should they be considered as fixed beams, and the negative moments at their ends from the floor loads be added to the wind-load moments?

The above are pertinent questions. More light is needed. It may be noted that in all high buildings, if the connections are rigid in the lower stories, they become less and less so farther up.

A suggestion found in "The Strength of Materials," by Prof. Ewart S. Andrews, is thrown out for discussion.

In building work the girders are usually connected to the stanchions or columns by means of cleat connections, which, owing to their rigidity, make it doubtful whether the girder will act as a freely supported beam, although their strength is almost invariably calculated as such. Neither is an ordinary cleat sufficiently rigid for the girder to be considered fixed at the ends. The actual bending-moment diagram for such beams will be somewhere between that of a freely supported and a fixed beam. It has been suggested that beams should be treated as "half-fixed"—that is, that the end moments should in the case of uniform loading be taken as $wl^2/24$. It will be noted that the maximum moment in this case is still $wl^2/12$, as in the fixed beam; such moment now occurs in the center.

ROBINS FLEMING.

New York City,
May 25, 1932.

NEWS OF THE WEEK

San Francisco Bay Bridge Plan Revised

Revised plans for the San Francisco Bay Bridge have been approved by the Secretary of War, according to an announcement made on May 26. The revised plans show a slight change in the location of the bridge and the substitution of suspension spans for cantilever spans in the San Francisco-Goat Island section, and a modification of the cantilever and approach spans for the Goat Island-Oakland section. The number of navigation openings remains the same but horizontal clearances are changed to afford considerably greater openings in the principal channel spans. Vertical clearances are unchanged in the Goat Island-Oakland section, but are reduced from 180 to 172 ft. at the piers adjacent to the shores of the San Francisco-Goat Island section, rising then to a maximum of 216 ft. in mid-channel where the previously approved plan provided 214 ft. Only one objection was raised to the proposed change. That was on the ground that a suspended span was more easily destroyed by bombing.

Application for approval was made to the War Department by the California Toll Bridge Authority, acting by and through the Department of Public Works of the State of California. The original plans were approved Jan. 19, 1932.

Baltimore Approves Form of Incineration Contract

Specifications for the construction and operation of an incinerator plant for garbage and rubbish in Baltimore, Md., were approved by the city on May 25. The specifications have been revised from their original form by a committee headed by Bernard L. Crozier, chief engineer of Baltimore. Bids to be opened on June 15 will be for the construction of the plant and its operation for a period of ten years and the collection of rubbish for five years. The site originally selected, Reed Bird Island, has been retained in the revised specifications, but the plant capacity has been changed from 900 tons to 600 tons.

Objections were made to the plant proposed originally on the ground that the transportation of all the city's garbage along one route would constitute a serious nuisance. The hauling route has accordingly been changed and the concentration of garbage at a single point will be only a temporary matter. An additional incinerator, to be located in the southeastern section of the city, is to be built after the one now proposed has been completed.

Two existing rubbish-destruction plants, in the northern and northeastern sections, respectively, will be remodeled to make them suitable for the incineration of combined rubbish and garbage. When the entire project is completed, there will be four incinerator plants to dispose of the city's refuse.

For some years past the city's garbage has been disposed of in a reduction plant, now to be abandoned. The contract for its operation had expired a few months ago and its operation has continued up to the present on temporary extension. Rubbish collection has been carried out on a separate contract but is now to be one of the items in the new contract for the incinerator plant construction and operation. Garbage will continue to be collected by the city.

It is estimated that the incinerator will cost $500,000 plus the cost of the equipment. The plant will be built by the contractor but will be turned over to the city at the expiration of the ten-year period.

High Water Expected on the Coast

High water in the southern interior of British Columbia this year may easily reach the levels of 1916, highest since the record year of 1894, according to Lorne Campbell, managing director of the West Kootenay Power & Light Co. All the company's power plants on the Kootenay River are built to take care of higher floods than that of 1894 but the high water may, in Mr. Campbell's opinion, effect some stretches of railway and road.

Texas Highway Load-Limit Law Upheld by Supreme Court

THE United States Supreme Court, in a decision rendered May 23, upheld the Texas law limiting the size, load and movement of motor vehicles on the highways of the state. The law limits the width of a vehicle, including its load, to 96 in., the height to 12½ ft., the length to 35 ft. and the length of coupled vehicles to 45 ft. It forbids transportation as a load of any commodities in containers having more than 30 cu.ft. and weighing more than 500 lb. where there are more than 14 such containers carried as a load, no load in any such container to be carried in excess of 7,000 lb. Exemptions are made for agricultural and road building machinery and well drilling outfits, also for large objects which must be transported as a unit. Provision also is made for the transportation of heavy loads to and from railway terminals by the shortest route or for the transportation of such heavy loads direct where the direct haul is less than the combined haul to and from the railway line. Wheel loads for both trucks and buses are limited to 600 lb. per inch width for tire concentrated upon the surface of the highway. These limitations apply to operations outside of the limits of incorporated cities or towns.

The state law was attacked on the ground that it discriminated unjustly against motor trucks and buses in operation in the state, also that it set up unnecessarily low load limits in order to force traffic, chiefly cotton traffic, back to the railway lines.

The Supreme Court stated that the district court had found that less than fourtenths of one per cent of the buses, trucks and automobiles registered in the state had a rated carrying capacity of more than 7,000 lb. Those attacking the law stated that provision could be made for the transportation of larger loads without injury to the highways by regulations making proper provision for the distribution of such loads through multiple axles and wheels to the highway surface. On this point the court said: "To make scientific precision a criterion of constitutional power would be to subject the state to an intolerable supervision hostile to the basic principles of our government and wholly beyond he protection which the general clause of the fourteenth amendment was intended to secure." The court said further: "In exercising its authority over its highways the state is not limited to the raising of revenue for maintenance and reconstruction, or to regulations as to the manner in which vehicles shall be operated, but the state may also prevent the wear and hazards due to excessive size of vehicles and weight of load. Limitations of size and weight are manifestly subjects within the broad range of legislative discretion."

"We do not find the provisions fixing the limit of length for individual motor vehicles and for a combination of such vehicles to be open to objection. If the state saw fit in this way to discourage the use of such trains or combinations on its highways, we know of no constitutional reason why it should not do so."

"It is said that the exception was designed to favor transportation by railroad as against transportation by motor truck. If this was the motive of the legislature, it does not follow that the classification as made in this case would be invalid. The state has a vital interest in the appropriate utilization of the railroads which serve its people as well as in the proper maintenance of its highways as safe and convenient facilities. The state provides its highways and pays for their upkeep. Its people make railroad transportation possible by the payment of transportation charges.

"It cannot be said that the state is powerless to protect its highways from being subjected to excessive burdens when other means of transportation are available. The use of highways for truck transportation has its manifest convenience, but we perceive no constitutional ground for denying to the state the right to foster a fair distribution of traffic to the end that all necessary facilities should be maintained and that the public should not be inconvenienced by inordinate use of its highways for purpose of gain."

Four Bids Made for Operation of New York's New Subway

Four offers, all but three of them informal, were submitted to the Board of Transportation of the City of New York on May 31, for the operation of the new city-built 8th Ave. subway. Two offers were from firms who have worked on the construction of the subways, the Oakdale Contracting Co. and the Rosoff Subway Construction Co., one was from the Aqua Engineering Co. of Philadelphia, and one from Ford, Bacon & Davis, management engineers, New York.

Only the bid of the Oakdale Contracting Co. was made in accordance with the revised form of contract put out by the board recently after no bids had been received. That company asked a fee of $4,000 a day from the start of operation to the end of June 1933, and thereafter amounts from $2,000,000 to $2,400,000 per year up to 1937 and $1,000,000 from 1937 to 1941. The Rosoff bid suggested numerous changes in form of contract and if the changes were found acceptable it proposed to take operating fees smaller than those asked by the Oakdale Corp. Both companies accompanied their bids by the required check of $150,000.

The two engineering firms submitted informal bids to operate the subways as managers on a fee basis.

Plans for High Rock-Fill Dam for Los Angeles Approved

The Los Angeles county board of supervisors, on May 25, approaved plans for the construction of Dam No. 1, county flood control project, two miles below the Forks Site in San Gabriel Canyon. The project will call for the expenditure of approximately $10,000,000. The estimated time to be required for construction is five and one-half years. Bids for construction of the dam will be called for after the opening soon of bids for the sale of flood control bonds. E. C. Eaton, chief engineer of the county flood control district, announced that the plans and specifications for the proposed 280-foot, rockfill type dam have been approved by the United States forestry department, state engineer and the Los Angeles county council. The proposed dam will impound 75,000 acre-feet of water to be used to regulate storage in conjunction with spreading grounds. Construction of Dam No. 2 in the same canyon already is in progress.

River and Harbor Work Justified Under Present Conditions

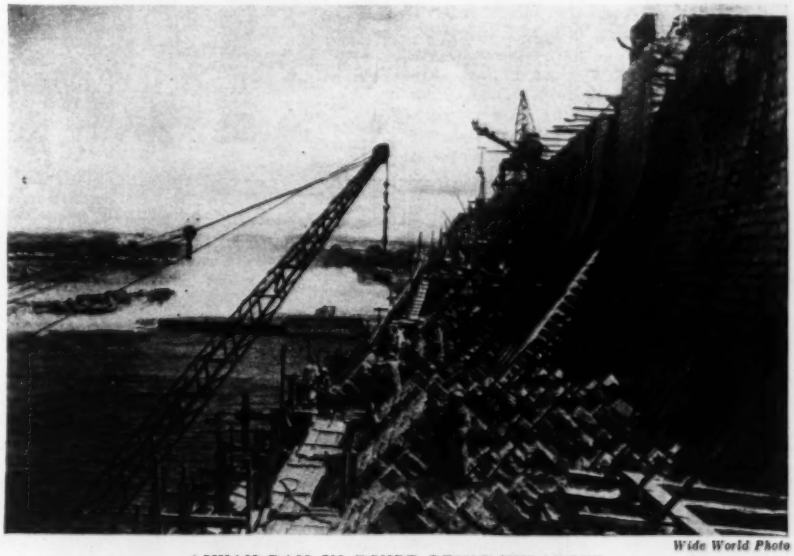
Three lists of river and harbor projects authorized by Congress and which are considered justified at the present in the interests of commerce and navigation, but for which money has not been provided, were presented to the House of Representatives by Lytle Brown, Chief of Engineers, U. S. Army, on May 25. The list of first priorities with the amounts required for their completion in addition to funds already in hand includes the following: Allegheny River, $5,825,000; Baltimore harbor and channel, $918,000; Caloosahatchee River-Lake Okeechobee drainage area, Florida, $6,149,000; Hudson River, $2,347,000; Illinois River, $5,275,000; Kanawha River, West Virginia, $4,000,000; Los Angeles and Long Beach harbors, $635,000; Mississippi River, Illinois River to Minneapolis, $6,950,000; Ohio River-Illinois River, $12,800,000; Missouri River, Kansas City to mouth, $11,290,000; Ohio River, open channel work, $4,650,000, lock and dam construction, $6,000,000; Oswego harbor, New York, $1,510,000; San Francisco harbor, $751,000; Taunton River, Mass., $590,000.

The second priority list included such large projects as that of $12,000,000 for the Detroit River; $6,980,000 for the East River at New York; $7,595,000 for the Louisiana-Texas inter-coastal waterway, and $5,202,000 for the St. Clair River in Michigan. The third priority list included $7,000,000 for the Los Angeles and Long Beach harbors and $3,500,000 for the Youghiogheny River in Pennsylvania. The total amount of the projects listed is $410,723,000.

Prevailing Wage Law Repeal Asked by U. S. Chamber of Commerce

Of chief interest to the construction industry among the resolutions adopted by the U. S. Chamber of Commerce at its meeting held in San Francisco May 17-20, was one relating to wages on public works. It stated that the law requiring that the so-called prevailing rate of wages be paid on federal work be immedaitely repealed and that no further consideration be given to the enlargement of these limitations now before Congress. This action was taken in the belief that it is in the public interest that those public funds devoted to decreased unemployment should be utilized to provide the largest amount of employment consistent with reasonable compensation. Other resolutions of interest were one urging that all barriers to interstate commerce be removed and that no impediment should be placed upon normal and legitimate methods of merchandising within the borders of the state and another urging that unregulated competition with regulated forms of transportation should be ended. The Chamber went on record as believing that the railroads should be authorized to provide all those services of transportation which are most advantageous to the areas which they serve and that the consolidation of railroads should be advanced with all possible speed. Retroactive repeal of the recapture provisions of the transportation act also was urged.

The session on organized effort in construction had as its first speaker Julius H. Barnes, chairman, executive committee, National Conference on Construction, who pointed out the opportunity in national effort offered by the present situation. George W. Kelham, architect, and president, Industrial Association of San Francisco, explained the organization and operation of the Industrial Association of San Francisco. G. B. Herington, consulting engineer, manager, Associated General Contractors of Portland, Ore., discussed eliminating wastes and undesirable practices. Under the title "Community Controls of Construction," Truman S. Morgan, president, The F. W. Dodge Corp., New York, described some of the methods of control in construction employed in New York.



Wide World Photo

ASWAN DAM IN EGYPT BEING ENLARGED

As part of the work of increasing the height of the Aswan Dam on the Nile river in Egypt, buttresses are being added to the down-stream face of the dam and new masonry is being added to the top. Buttresses are of reinforced concrete faced with stone masonry to harmonize with the existing structure. They are built free from the face of the dam, the existing stone being dressed down to a smooth surface and covered with plates of special rust-resisting iron against which the new masonry is built. Details of the methods to be used in enlarging the dam were given in *Engineering News-Record*, Feb. 1st, 1929, p. 278.

The height of the dam is increased about 30 ft. In 1907 it was increased about 15 ft. by adding new masonry to the top and down-stream face of the dam, this masonry being bonded to the original structure.

Financing of Municipal Work by R.F.C. Asked at Seattle

The Washington State Committee of the American Engineering Council, headed by Joseph Jacobs, Seattle, has gone on record in favor of amending the act which created the Reconstruction Finance Corporation to permit the purchase by the corporation of municipal securities, and is urging the administrative heads of local governments within the state to request Washington representatives in Congress to work for amendment of the act.

The committee believes that the exclusion of municipal securities from among those securities which the corporation is able to purchase is considered unfortunate, and points out that unemployment relief programs are being seriously handicapped by the inability of municipalities to sell their bonds.

Postponement of Construction of Dotsero Cutoff Asked

The Denver & Rio Grande Western R.R. Co. has asked the Interstate Commerce Commission for further postponement of the start of construction of the cutoff connecting the Denver and Salt Lake Ry. west of the Moffat tunnel with the main line of the Denver & Rio Grande Western. An extension of time from March 15 to June 15 was recently granted the railroad company by the commission.

The company now has notified the commission that only by means of a loan from the Reconstruction Finance Corp. can it undertake construction of the cut-off. Reluctant to assume such an obligation under present conditions, the road asks the commission to postpone the date by which it is required to start work on the $3,500,000 project from June 15 next to March 15, 1933. In its petition the road complained that under the commission's last order it was given only 3 months in which to raise funds to commence construction and buy up 20,530 shares of Denver & Salt Lake Railway minority stock at $155. If denied the extension of time, the Denver company asks "as a last resort" that sufficient time be granted to enable it to submit an application for a loan from the R. F. C.

Need for Standardization Urged on National Lime Association

Lack of standardization and the existence of vague specifications are two factors militating greatly against the effective use of lime in the construction field. This fact was stressed at the fourteenth annual convention of the National Lime Association, held in Cleveland May 24 and 25. Discussion of industry problems, with the accent on selling methods, occupied three of the four sessions.

Though his subject was "Is the Lime Industry Suffering from Overproduction?" Donal O'Connor, general sales manager, Rockland & Rockport Lime Corp., deviated some from the subject to emphasize the need for proper standards which would go far toward establishing a reputation for lime which the industry believes it deserves. He recited a number of specifications he had met which indicated that many architects had but a vague notion of the extent to which lime could be used in building construction.

Willard T. Chevalier, publishing director, *Engineering News-Record*, speaking at the opening session, departed from the subject assigned to him in order to answer President Hoover's arguments against public works construction, the President's open letter to the American Society of Civil Engineers having been made public the day before.

Water Resource Studies in Illinois Now All Under One Agency

Through a reorganization and consolidation of duties the Illinois Water Survey, headed by A. M. Buswell, has undertaken the work of measurement of stream flow. This is being done under a cooperative agreement with the U. S. Geological Survey, which has transferred one of its engineers in Chicago to Urbana. The Illinois State Geological Survey has assigned a geologist to the water survey to devote his entire time to water resources. All of the sanitary work has now been left to the State Board of Health, the water survey discontinuing to give opinions on the hygienic, physiological or medicinal qualities of water but retaining determination of mineral qualities. For many years the overlap with the State Board of Health has been the cause of more or less friction which now bids fair to disappear.

In furtherance of the above work a questionnaire has recently been sent to consulting engineers, municipalities and corporations requesting their reasons for desiring the collection of stream measurements, suggestions for the location of stations and whether municipalities contemplating improvements might not bear a portion of the cost of establishing and maintaining a gaging station.

Randolph Made Director of Operations for World's Fair

Robert I. Randolph has been appointed director of operations and maintenance of Chicago's Century of Progress Exposition, which will open next year. Mr. Randolph is president of the Mississippi Valley Association and a member of the Chicago Engineers Club, the Western Society of Engineers, the Society of Military Engineers and the American Society of Civil Engineers. He will be in charge of air, land and water transportation, such utilities as water, sewage, gas, electricity, telephone, telegraph and post offices, and the police and fire-protection forces of the exposition.

Summerall to Head Florida Trans-State Canal Body

Gen. Charles P. Summerall, former Chief of Staff, U.S.A., has been elected president of the recently organized National Gulf-Atlantic Ship Canal Association, whose object is to bring to consummation plans for a ship canal across the northern part of the Florida peninsula.

Gen. Summerall, in his letter of acceptance, stresses the fact that such a canal would handle a heavier tonnage than the Panama Canal and on the basis of 1929 shipping would make an annual saving to the United States of nearly 33½ million dollars. The association points out that on a round trip between New York and New Orleans the canal would mean the saving of 783 nautical miles, or three days of sailing time. Between New York and Houston the saving would be 731 miles, or 2¾ days.

The length of the proposed canal is 160 miles, the depth 35 ft. and the bottom width 300 ft. Its cost is estimated as between 45 and 46 million dollars.

Western Society Meeting Discloses Unabated Activity for Past Year

FOLLOWING the installation of officers and a report on the year's activities of the Western Society of Engineers at its annual meeting May 24, the speaker of the evening, James Weber Linn, professor of English, University of Chicago, told the members that their education and their traditions prevent them from carrying the burden and responsibilities of the advanced civilization they created. He would give more attention to educating the student as a human being than as an engineer. Few engineering schools he stated impress their individuality on the student, so that most graduates are similar. They are trained as "generals rather than as privates." Important things in detail in Mr. Linn's opinion are to know how to read, how to express one's ideas, how to perform mathematical processes and use one's hands in the laboratory and drafting room. Withal, Mr. Linn said, the engineer is the best example and most typical product of present-day American civilization.

In the annual review Frank D. Chase, retiring president, stated that although the society closes the year with only a slight deficit it is balancing its budget and none of its investments have defaulted. More than 200 members are at work on committees, 6,000 used the library, 3,500 calls for information were received and 600 attended the four excursions provided. The civic affairs committee has submitted reports on the status and future of the Chicago metropolitan district relating to parks and playgrounds, local passenger transportation, local improvement act under which special assessment work is carried out, taxation, streets and highways, garbage. A special report on the minimum wage law was made.

The joint employment agency in which the society participates with the founder societies has placed 70 men.

The Charles Ellet cup award for the best paper by a junior went to Francis E. Wolosewick for his paper on "Theoretical Analyses of Pile Stresses in Soil." Forty to 100 young members participate weekly in the many social and technical activities of the Junior Engineers. They administer the Ellet award.

Daniel J. Brumley, chief engineer, Chicago Terminal Improvements, Illinois Central Ry., is the new president.

Chicago Construction Industries Hold Organization Meeting

On May 26 the new Construction Industries Council of the Chicago Association of Commerce, formed to amalgamate the common interests of engineers, architects, builders, contractors and material men with a view to accelerating construction, held its opening meeting. The chairman, Gerhardt F. Meyne, contractor, suggested that freight rates on raw materials are too high; that study of blighted slum areas needs support; that the real estate mortgage bond situation needs the attention of the investment banker, who should be compelled to clean house by legislation or other means. Taxation in Chicago is on the way to reform, but the next tax roll will show 25 to 30 per cent shrinkage and the council can assist in forcing governments to live within their income.

Taxation was covered more fully by D. F. Kelly, chairman of a citizens' committee on public expenditures, who suggested, as a measure to put men to work, that a new taxing district be created to reduce blighted areas, patterning after Germany in making model housing quarters for workmen. Federal funds if allotted to Chicago for any make-work projects could be used there. Vacant space for office and commercial uses now totals 270,000 sq.ft., he said, so that rebuilding the thousands of slum structures is one place where construction can be prosecuted without producing a surplus. A semi-public organization with powers of condemnation and controlled profits is being worked out by a state commission.

Temporary Work Outside of the Profession Urged at Detroit

Temporary work outside of the engineering profession during the present depression is urged upon engineers now out of employment by the executive committee of the Detroit Section, American Society of Civil Engineers. The committee is confident that the services of these men will be required in the future when business conditions improve and it believes that their standing in the profession will not be jeopardized by their accepting any kind of gainful employment in order to support themselves and conserve their resources until new openings in the profession develop. We believe, the committee states, that such gainful work during this period should in the future be looked upon as a credit to the man and that it should not and will not in any way reflect against his professional standing, now or in the future.

Hoover Dam Notes

High water in the Colorado River during the week ended May 21 made it impossible to remove muck from the excavations being made for the Nevada intake towers. The river has been rising steadily, since May 7. On May 21 the flow at Boulder City was 90,000 sec.-ft. Excavation was continued, however, in the open cuts for the Nevada and Arizona spillways.

Concrete poured to date in the diversion tunnels is as follows: tunnel No. 2—invert 766 ft., side walls 526 ft.; tunnel No. 3—invert 864 ft., side walls 384 ft.; tunnel No. 4—invert 343 ft.

Preliminary drafts of specifications for the first battery of turbines for the power plant are being sent to turbine manufacturers, to city authorities of Los Angeles and to the Southern California Edison Co. for comment and suggestion. Studies are continuing of methods of handling the steel penstocks and the pressure rises in the pipes. Bend losses in the outlet works and the penstocks are being studied at Colorado Agricultural College at Ft. Collins.

A survey of Boulder City just completed shows that there are 900 buildings in the town. This includes structures under construction. Of the total 814 are residences, 13 are dormitories and 56 are business buildings. The government owns 109 of the buildings, permittees also own 109, while Six Companies, Inc., own 682. When the buildings under construction are completed, the town will have accommodations for 4,500.

FIRST UNIT OF FIELD BUILDING IN CHICAGO NEARS COMPLETION

Occupying the site of the old Home Insurance Building in Chicago, the first unit of the Field Building, Chicago's largest office structure is now practically completed. The present unit, fronting 189 ft. on LaSalle St., extends back about 90 ft. on Adams St. and is 23 stories high. The completed building will have a frontage on Adams St. of 323 ft. and will be 42 stories high, a nineteen-story tower rising in the center. Only the lower fourteen floors of the first unit will be available for renting at present, inasmuch as no express elevators are located in this unit to serve the upper floors. It is planned that a second unit directly behind this one will be completed in May, 1933, incorporating express elevators, and the third unit, including the nineteen-story tower, in May, 1934. A rentable floor area of 1,000,000 sq.ft. is provided. Graham, Anderson, Probst & White, Chicago, are the architects and the George A. Fuller Co., New York, is the contractor.

Power Project on Current River Gets Preliminary Permit

A preliminary permit for the construction of three hydro-electric power projects on the Current River in Missouri was granted to the Current River Power Co., of Kansas City, on May 20 by the Federal Power Commission. A preliminary permit does not authorize the start of construction, but gives the holder a preferential right to develop the site. The three power sites are located at Hargun Eddy, Mill Creek and Blair Creek. The power capacity of the combined plant is put at about 26,000 hp. Gravity-type concrete dams of heights ranging from 84 to 104 ft. are planned.

Washington Notes

By Paul Wooton
Washington Correspondent

Uncertainty as to the appropriations for highway purposes continues. The House of Representatives committee finally approved the regular federal-aid bill but cut the total from $125,000,000 to $100,000,000. From that total the $16,000,000 installment to be paid on the emergency fund, advanced last year, must be deducted. In addition the bill carries authorizations for forest roads at the rate of $7,500,000 yearly and $2,000,000 for roads on public lands. In all the bill carries authorizations totaling $219,000,000 for the fiscal years 1934 and 1935. This bill is now on the House calendar along with the $132,000,000 emergency bill. The regular bill doubtless will be passed before Congress adjourns. The Senate committee has reported the bill in its original form, carrying $125,000,000 for federal aid; $12,500,000 for forest roads; $3,000,000 for roads on public lands and $1,500,000 for roads in national parks. These differences will have to be reconciled in the conference committee. Just when the bill can be brought before either house is very uncertain.

Railway Construction Order Challenged

Challenged by the Union Pacific, the validity of the Interstate Commerce Commission's order requiring construction at a cost of $9,000,000 of a 185-mile line across the "high desert" of central Oregon will be determined by the U. S. Supreme Court. Chief Justice Hughes announced last week that the court had consented to hear the appeal taken by the I.C.C. from the decision of the U. S. district court at Portland that the commission had exceeded its authority under the Interstate Commerce Act to require a road to extend its lines when reasonably required by public convenience and necessity, provided that the expense involved will not impair the carrier's ability to perform its duty to the public.

The railroads construe this provision of the law as referring to construction of short extensions or branches in territory naturally tributary to their lines. They contend that otherwise the law would be unconstitutional in that it gives the I.C.C. practically unlimited power to compel investment of private capital in new and unprofitable territory, expenditures which might amount to confiscation.

Two Summer Schools to Be Held for Engineering Teachers

Two summer schools are to be held in July for engineering teachers under the direction of the Society for the Promotion of Engineering Education. One school is to be held at Stevens Institute of Technology, Hoboken, N. J., July 5 to 21. The subject of this session will be Economics. The teaching staff, under the chairmanship of William D. Ennis, professor of economics of engineering at Stevens Institute, will include deans of engineering and professors of economics of most of the principal schools of the country, also industrial executives and consulting engineers.

A section devoted to English will be held at the Ohio State University, Columbus, Ohio, July 11-28. Its teaching staff will be headed by S. A. Harbarger, chairman of the committee of English of the society, and assistant professor of English at Ohio State University.

Personal Notes

L. L. Davis, formerly principal engineer in the U. S. District Engineer Office, Buffalo, N. Y., is now resident engineer in the U. S. Engineer Office at Oswego, succeeding Waveland S. FitzSimons, who resigned recently.

R. E. McMullen, senior engineering inspector foreman, U. S. Bureau of Roads, has been transferred from Portland, Ore., to the Transmountain Highway project, Glacier Park, Mont.

Clement J. Freund, formerly head of the personnel department of the Falk Corp., Milwaukee, has been appointed dean of the college of engineering of the University of Detroit to succeed Russell Lawrence, resigned.

D. C. Walmsley and R. E. Frierson, formerly of the construction department of the Missouri Pacific Ry., have formed a partnership for general engineering service with headquarters at Dallas, Texas.

Arthur K. Hinds, civil engineer, vice-president and manager of the Carthage Machine Co. since 1922, has resigned his position to become associated with the Climax Manufacturing Co. of Castorland, N. Y.

C. E. Griggs, consulting engineer of Phoenix, Ariz., has been appointed city engineer vice W. J. Jamieson. The position includes that of street superintendent.

Harry A. Hageman, formerly chief hydraulic engineer, Stone and Webster Engineering Corporation, Boston, is now public buildings commissioner of the City of Newton, Mass.

A. W. Carpenter, formerly assistant valuation engineer, New York Central Lines, has been appointed engineer of bridges, New York Central Railroad Co. vice J. L. Miller, deceased. Mr. Carpenter's headquarters will contnue to be in New York City. Mr. Carpenter entered the New York Central service in 1900 and served as engineer of bridges from 1904 to 1906 before his transfer to the valuation department.

Norman F. Williams, formerly superintendent for Allied Engineers, Inc., on the construction of the Blue Ridge Dam in Georgia, recently was appointed chief engineer of the Tennessee Electric Power Co., Chattanooga, Tenn.

Horace Hovey Esselstyn, Detroit, was elected city manager of San Diego, Calif., on May 19, a position created under the new charter. Mr. Esselstyn was born in Detroit but received his public school education in New York City, taking architecture at Columbia University and civil engineering at Cooper Union. He went to Porto Rico as engineer on highway work being done by the U. S. Government. Later he was an engineer on railway construction, and, during the War, was resident engineer at the Hog Island Ship Yard Plant at Philadelphia. Later he was appointed commissioner of public works at Detroit, serving one year, and then was appointed engineer in charge of design and supervision of the Belle Isle Bridge. More recently he has been in the contracting business and serving as consulting engineer on numerous projects.

SOCIETY CALENDAR

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, June 20-24.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS, annual meeting, Ohio State University, Columbus, Ohio, June 20-23, 1932.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual convention, Yellowstone National Park, July 6-9.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, 40th annual meeting, Oregon State College, Corvallis, June 29-July 1.

NEW YORK STATE SEWAGE WORKS ASSOCIATION will hold its spring meeting in Buffalo, June 10-11. The program will include a round-table discussion of sewage disposal problems and visits to five disposal plants in the neighborhood of Buffalo.

LOS ANGELES SECTION, American Society of Civil Engineers, held its regular monthly meeting May 11 at the California Institute of Technology. Lectures and demonstrations of corona, insulation puncture and insulation arc-over were given in the laboratory. Another demonstration was given in the aerodynamics wind tunnel of the method of studying a model of an air craft in flight.

ILLINOIS SECTION, American Society of Civil Engineers, May 27 presented its annual award of certificates of junior memberships to C. E. Carlsen, Purdue University; E. L. Foster, Purdue University; William P. Jones, University of Illinois; Joe J. Koperski, Lewis Institute; Charles U. Kring, University of Illinois; Maynard A. Patton, Northwestern University; Torgny J. Westerberg, Armour Institute of Technology; Howard L. White, Rose Polytechnic Institute. The awards are made on the following basis: 40 per cent on scholarship, 20 per cent on personality, 20 per cent on engineering ability, 10 per cent on student activities of an engineering nature and 10 per cent on public speaking.

NATIONAL ASSOCIATION OF RAILROAD TIE PRODUCERS held its fourteenth annual session in Memphis May 17-18. Officers were elected as follows: president, S. S. Watson, Chicago; vice-presidents, B. N. Johnson, Richmond, Ind., and E. C. Jones, Chicago; secretary-treasurer, Roy M. Edmonds, St. Louis. The meeting adopted a resolution memorializing Congress to cut federal expenses by bureau elimination, combination of offices and reduction of salaries. Regulation of carriers competing with railroads was also asked. No place was selected for the 1933 meeting.

Obituary

John A. Drew, formerly general manager, the Worthington Pump & Machinery Co., died at his home in Brooklyn on May 25. He had been associated with the company and its predecessors for 60 years.

George W. Wales, one of the few engineers who saw continuous service on construction of the Panama Canal, died at Tacoma, Wash., on May 22. He was 77 years old.

Louis C. Datz, chief engineer of the St. Louis Public Service Co., died there suddenly on May 20. A graduate of Tulane University, Mr. Datz went to St. Louis in 1925 for the reorganization of the street railway system, then in receivership. In 1927, when the Public Service Co. took over the street railway he became chief engineer. Previously he had held similar positions with the street railway systems of New Orleans and Memphis.

John S. Branne, consulting engineer, New York, died at his home in Mt. Vernon, N. Y., on May 25. Mr. Branne was a native of Norway and came to this country in 1888. From that time until 1907 he was in bridge design work with various bridge companies. From 1907 he has been in private practice, specializing in bridge design and material handling equipment.

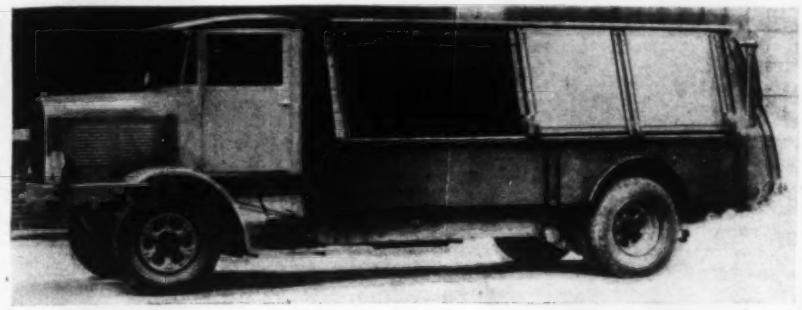
James L. Miller, engineer of bridges, New York Central Railroad Company, New York, died there on April 29. Mr. Miller was a native of New York City and a graduate in civil engineering from Columbia University. He began work with the New York Central in 1903, becoming assistant engineer in 1906 and engineer of bridges in 1911.

John Laing Weller, who was in charge of the early work on the construction of the Welland Ship Canal, died in Hamilton, Ont., on May 24, aged 70 years. He was born in Coburg, Ont., and graduated in engineering from the Royal Military College, Kingston. Mr. Weller entered government service in the Department of Railways and Canals in 1883. From that time until 1888 he was engaged on the construction of the Trent Canal. During the next two years he was principal assistant engineer on the enlargement of the Ontario-St. Lawrence canals, and shortly afterward he became engineer in charge of the Port Colbourne improvements, following which he was appointed Superintendent in charge of the Welland Canal. In 1912 when the government decided on the enlargement of the canal, Mr. Weller was appointed engineer in charge of surveys, designs and construction of the new canal. This work was interrupted by the War and on its resumption in 1919 he became consulting engineer. Port Weller, the new eastern terminal of the canal, was so named in his honor.

Construction Equipment and Materials

Low-Bed Front-Wheel-Drive Truck

A new low-bed 5-ton front-wheel-drive truck with a frame height of 21 in. has been put in production by the Four Wheel Drive Auto Co., of Clintonville, Wis. This truck, designated as the LBU model, is powered by a 91-hp. high-compression motor. The low bed is especially adaptable to specialized hauling applications where hand loading or unloading is necessary. For refuse collection this model carries bodies of many different types of 10- to 20-cu.yd. capacity. Any type of body is available. The system of power transmission used in this model is the same as that found in the regular four-wheel-drive vehicles manufactured by the FWD, except that the rear driving mechanism is omitted. Power is transmitted from the motor through a four-speed unit transmission. The frame construction of this model is made up of two sections on different levels joined together by gusset plates. The drop in the frame is made at the rear of the cab.

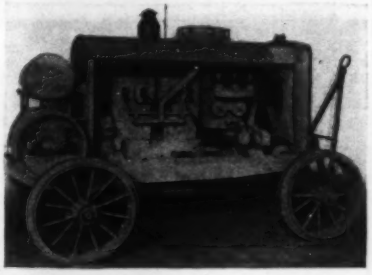


FWD front-wheel-drive low bed truck.

New Line of Air Compressors

The Le Roi Co., Milwaukee, Wis., announces a complete line of portable and stationary air compressors, to be known as the Le Roi-Rix line. Stationary models are built in six sizes, ranging from 100- to 600-cu.ft. displacement, and can be furnished powered either by Le Roi engines or by electric motors. The portable machines are powered by Le Roi engines and are built in seven sizes, ranging from 18- to 310-cu.ft. displacement. Le Roi-Rix compressors are built with a patented Rix supercharger, which is claimed to make them unusually efficient.

Le Roi-Rix portable compressor.



New Publications

Engine-Driven Arc Welder—Schramm, Inc., West Chester, Pa., announces its new bulletin 3225 covering the company's entire line of engine-driven arc welders. The bulletin includes complete descriptions of the single- and double-arc 200-, 300-, 400- and 600-amp. welders for industrial use and describes the railroad type self-propelled variable voltage welder used for repairing battered rail ends, frogs and switches, and for bridge repair work. A new machine described is the constant voltage two-arc rail car welder in which generators are compounded so that with 3,000 ft. of welding cable in the circuit, 225 amp. flow through the arc at normal arc voltage and a surplus current is available for grinders and other tools.

Scientific Automatic Weighing—A booklet entitled "Scale-ology," devoted to scientific automatic weighing, has been published by the Kron Co., Bridgeport, Conn.

Cementing Compounds—Technical Products Co., Sharpsburg Station, Pittsburgh, Pa., has issued Insa-Lute Cement and Compounds Catalog No. 32 containing information on industrial assembling, insulating, acid-proofing, etc. These compounds are applicable to the building and construction field in setting plumbing and electrical fixtures, waterproofing masonry, fastening wallboard and for pipe joints.

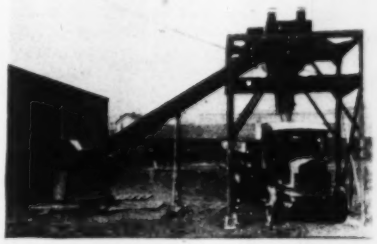
Centrifugal Pumps—The monobloc type of centrifugal pumps, bolted to the motor frame with impeller mounted on motor shaft, is described in bulletin W-321-S1A issued by the Worthington Pump & Machinery Corp., Harrison, N. J. Rating tables and pump combinations with motor characteristics are given.

Vibrating Screens—Folder 1262 issued by Link-Belt Co., Philadelphia, Pa., describes two new types of vibrating screens, known as the Link-Belt positive-drive type and the Link-Belt unbalanced pulley type.

Stationary Diesel Engines—Worthington Pump & Machinery Corp., Harrison, N. J., has published a series of bulletins describing its various sizes of four-cycle direct-injection type stationary diesel engines. Bulletin S-500-B5A covers the 50- to 150-hp. sizes; bulletin S-500-S5 describes the 150- to 300-hp. sizes; 225- to 450-hp. sizes are covered in bulletin S-500-B7; 300- to 600-hp. sizes are described in bulletin S-500-S4 and bulletin S-500-S6 covers sizes ranging from 375 to 1,000 hp.

Bulk Cement Plant

A handy bulk cement plant which batches the cement direct from the car without use of an intermediate storage bin, has been developed by the Blaw-Knox Co., Pittsburgh. The plant consists of a hinged hopper placed at the car door, an inclosed screw conveyor and a 1,000-lb. double-beam cement-weighing batcher. This batcher is equipped with springless dial indicators which show when the batcher is full or empty. The hopper is adaptable for loading from the car by wheelbarrow or by scoop shovel. A four-cylinder gas engine operates the screw conveyor. The entire plant is easily portable.



Blaw-Knox portable bulk cement plant.

New Equipment in Brief

Oil Retainer for Ball Bearings—Standard Steel & Bearings, Inc., Plainville, Conn., announces a new retainer and oil seal for ball bearings. The retainer is composed of two circular plates wedged together into a groove in the outer ring of the bearing. Contained between these two circular plates is a wiper or ring of felt that makes contact with the inner ring of the bearing. The felt wiper forms a dam that retains the lubricant within the bearing.

Position Finders for Welding—Harnischfeger Corp., Milwaukee, Wis., has entered the welding field with the introduction of the P&H Position Finder. The device is for handling and holding heavy parts at such angles as to permit the 45-deg. welding necessary for smooth, strong welds. There are two types, manual operated and table mounted. The first type is for long, narrow parts to be welded on all sides. It will handle pieces up to 16 ft. in length. The table model, built in two sizes, will handle pieces weighing 4,000 lb. and 8,000 lb., respectively. These models are electrically operated.

Business Notes

H. O. Penn Machinery Co., New York, has appointed D. D. Barnes as sales manager. Mr. Barnes was formerly sales manager for the Smith Engineering Works.

Pittsburgh Equitable Meter Co. and Merco Nordstrom Valve Co. have consolidated, and the latter firm will operate as a division of the Pittsburgh Equitable Meter Co. W. F. Rockwell, of the Pittsburgh company, becomes president of the Merco Nordstrom Valve Co. Sales offices of each company will be available to the other.

Joseph T. Ryerson & Son, Inc., has purchased the stock and good will of the steel department of H. D. Taylor & Co., Buffalo.

Business Side of Construction

May Contracts Show 10 Per Cent Gain Over April Awards

Engineering construction contracts reported for the month of May total 105 millions, an increase of 10 per cent over the previous month's awards. Public construction in May gained 18 per cent, while private work dropped 6 per cent. For the first five months of 1932, contracts reported total 454 millions, or but 38 per cent of the value reported for a similar period last year. The 1932 contract figures to date are but 29 per cent of those of the same period in 1930.

Public contracts for the first five months of 1932 total 277 millions, or 42 per cent of last year's total, while private work, amounting to 177 millions, is only one-third of that reported to date in 1931.

Fewer Scale Cuts in May

There were but six cities throughout the country in which building-trades wage scales were cut appreciably during May. In thirteen cities lower scales had become effective May 1.

Boston—Bricklayers' official scale cut 20c. per hour, to $1.30. Steamfitters accept 16 per cent cut to $1.50 per hour; helpers, 90c. Shipbuilders walk out in protest against 10 per cent reduction.

Fall River—Plumbers and steamfitters strike in protest against 20 per cent reduction, to 80c. per hour.

Poughkeepsie—Bricklayers strike in protest against reduction of $2.50 per day, to $11. Strike, however, confined to state building project, bricklayers on private projects having accepted the cut.

Utica—Plumbers and steamfitters accept another 20 per cent reduction in addition to the 10 per cent cut of last winter. New rate $1 per hour.

New York—Seventeen building trades have returned to work, leaving 21 still out in the strike against reduction in wage scale. Elevator constructors refuse to accept $10 scale to which eighteen other unions have agreed. Bricklayers' union accepts the arbitral award of $1.65 per hour, pledged by the Associated Brick Masons Contractors, Inc., and rejects the offer of $1.50 per hour made by the Mason Builder Association.

Trenton—Bricklayers, plasterers and masons accept 20 per cent cut in scale. Carpenters and iron workers refuse the offer of reduced scale, the carpenters having accepted a cut of $2 per day, to $10, in February, 1932.

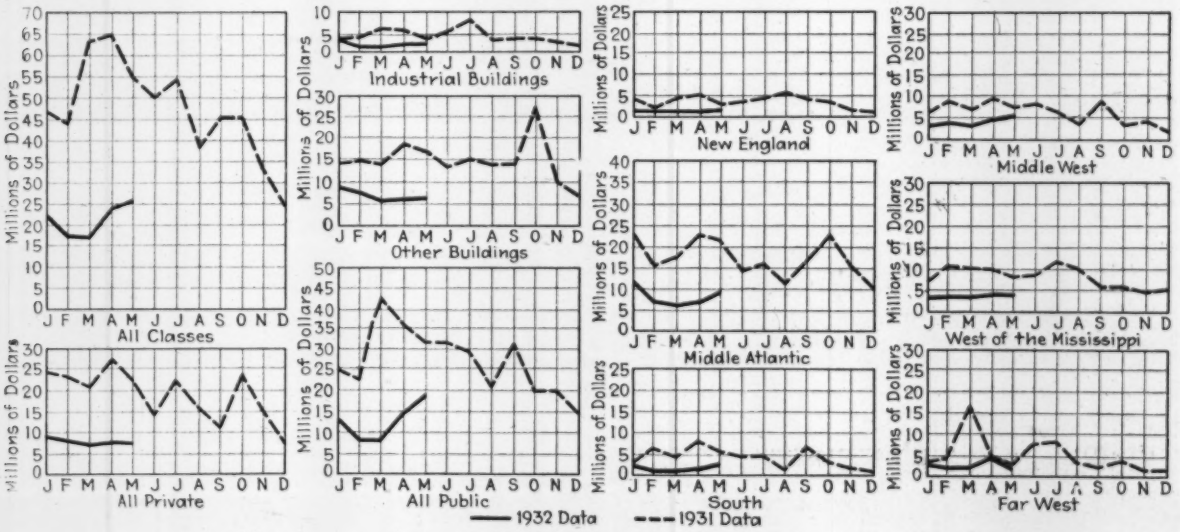
Washington (D. C.)—Carpenters reject compromise offer of $9 per day, after having refused proposed cut from $11 to $8. Contractors on private work have declared open shop.

Pittsburgh — New bricklayers' union organized for the purpose of establishing a basic wage scale of $8 per eight-hour day. Scale for the older union was re-

ENGINEERING CONSTRUCTION CONTRACTS REPORTED IN MAY, 1932

Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States			Canada
							May, 1932	Five Months		May 1932
								1932	1931	
Waterworks	152	668	88	421	781	92	2,202	8,541	26,550	90
Sewers	256	938	26	176	480	83	1,959	11,185	30,403	216
Bridges, public	247	555	196	832	1,223	508	3,561	17,557	45,374	37
Excavations	40	100	16	74	15	29	274	1,666	11,139	169
Streets and roads	2,755	2,883	3,876	10,173	9,600	4,092	33,379	99,343	274,480	1,858
Federal government	338	10,262	5,846	5,041	2,100	1,299	24,886	73,785	128,101	.....
Unclassified, public	277	1,426	29	220	112	184	2,248	21,892	45,650	429
Buildings, public	605	4,737	.....	1,172	150	212	6,876	42,860	105,711	1,096
Total public	4,670	21,569	10,077	18,109	14,461	6,499	75,385	276,829	667,408	3,895
Buildings, industrial	595	4,170	225	1,353	645	190	7,178	38,425	80,391	785
Buildings, commercial	3,193	9,260	.....	1,875	475	565	15,368	102,176	272,733	925
Bridges, private	.....	325	38	.....	.....	.....	363	1,603	6,553	.....
Unclassified, private	285	4,394	280	475	829	530	6,793	35,293	170,736	.....
Total private	4,073	18,149	543	3,703	1,949	1,285	29,702	177,497	530,413	1,710
May, 1932	**8,743**	**39,718**	**10,620**	**21,812**	**16,410**	**7,784**	**105,087**	.....	.....	**5,605**
April, 1932	7,662	26,496	7,593	18,273	17,098	18,483	95,605	.....	.....	3,232
May, 1931	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Five months, 1932	36,420	167,542	31,765	80,861	76,607	61,131	.....	454,326	.....	24,756
Five months, 1931	79,656	462,396	125,255	184,253	193,541	152,720	.....	.....	1,197,821	53,002



Value of contracts awarded—Weekly averages.

cently reduced $2, to $12. Wages and salaries reduced 15 per cent, May, 16, by United States Steel Corp. and subsidiaries. In October, 1931, the corporation cut wages 10 per cent, and in July, 1931, 10 to 15 per cent. These mark the three major wage reductions to occur in the steel industry since the depression began.

St. Louis—Plumbers accept scale cut of $1.50 per day, to $11.60, effective May 17. Steamfitters recently took similar cut. All building-trades unions now at work under new scales, which represent from 4 to 17 per cent reduction from the old rates.

Detroit—Dredge workers on the Great Lakes accept reduction of $35 per month, to a minimum of $147.50.

Minneapolis—City preparing construction program to employ 1,100 men to the end of the summer season, on 36-hour weekly schedule.

Pueblo—State Industrial Commission refuses to permit contractors to reduce wages of building-trades mechanics 20 per cent. Commission claims such reduction would bring wages below normal living levels. The commission is willing, however, to permit a reduction of 10 per cent.

Materials Notes

Costs in various sections of the country where construction is proportionately heavy average 74 per cent under year-ago levels.

Steel—Unfilled tonnage on books of the United States Steel Corp. has touched a new record low point each successive month since the first of this year. The May 1 total is 2,326,926 tons, compared with 3,897,759 tons on the corresponding date in 1931.

Cement—Mill shipments in the period Jan. 1 to May 1, 1932, aggregated 17,020,000 bbl., compared with stocks of 26,487,000 bbl. at the end of that time. In the comparable months of 1931, shipments totaled 28,142,000 bbl., against stocks of 29,715,000 bbl.

Lumber—The entire industry is engulfed in what is undoubtedly its worst slump in the last twenty years. The January-to-June consumption for building exclusively reached but 2,371,000,000 ft., against 8,375,000,000 ft. in the same period of 1931, and 17,053,000,000 ft. in the same months of 1929. Stocks at dealers' yards are nil. The dealer, in many cases, is buying from mill only after having made a sale, instead of keeping a stock in reserve.

Brick—Yard shipments are being made at the rate of 55,000,000 bricks monthly, compared with stocks of 579,000,000 left over at the end of the month. At this time last year, shipments amounted to but 29,000,000, with stocks at 256,000,000. Shipments are 10 per cent of stocks, as compared with 11 per cent a year ago.

Capital and Contracts

Total value of engineering construction contracts for the United States for the week of June 2, 1932, also new capital issues, together with year-ago comparisons follow:

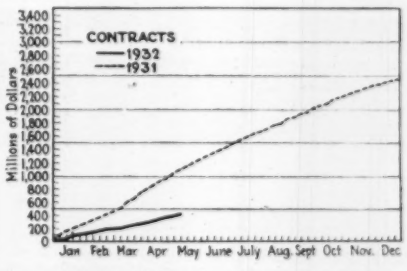
(Thousands of Dollars)

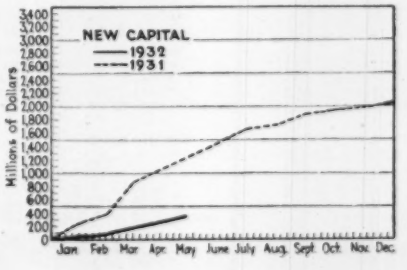
	Week of June 2, 1932	Average Week May, 1932	Average Week June, 1931
Construction:			
Federal government	$1,381	$6,221	$5,039
State and municipal	8,704	12,744	26,394
Total public	$10,085	$18,966	$31,434
Total private	4,868	7,419	17,647
Weeks total	$14,953	$26,385	$49,08

New Productive Capital:	Week of May 28, 1932	Average Week May, 1932	Average Week May, 1931
Public	$9,000	$17,500	$28,000
Private	2,000	2,000	26,200
Weeks total	$11,000	$18,500	$54,200

Cumulative, Construction and Capital, Jan. 1 to date:

1932, construction	$469,279
1931, construction	1,253,500
Decrease, 63 per cent	
1932, capital	$355,000
1931, capital	1,295,000
Decrease, 73 per cent	





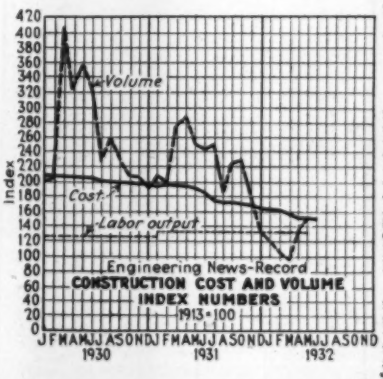
CURRENT BUILDING AND CONSTRUCTION TRADES WAGE RATES PER HOUR

Advances since last month are indicated by **heavy type,** declines by *italics*

Cities	Bricklayers	Carpenters	Hoisting Engineers	Pile Drivers	Structural Iron Workers	Masons' Laborers	Common Laborers
Atlanta	$0.75@1.25	$0.40@.60	$0.60@1.00	.....	$0.60@1.10	*$0.35*	$.20@.35
Baltimore	1.00	.80@.90	1.00@1.37½	$0.65	1.00@1.25	*.35*	.30
Birmingham	.75@.87½	.60	.75	.....	.75	.35	.15@.25
Boston	1.00@*1.30*	1.00@1.17½	1.00@1.37½	1.07½	1.00@1.37½	.70	.50@.70
Cincinnati	.90@1.27½	.50@1.02½	1.07½	1.07½	1.20	.70	.25@.45
Chicago	1.37½	1.31½	1.31½	1.31½	1.35	.82½	.50@.82
Cleveland	.90	.87½	.90@1.00	1.00	.90@1.00	.56¼	.30@.40
Dallas	1.00@1.12½	.75@.87½	.87½	.87½	.87½	30.@.40	.20@.25
Denver	1.00@1.12½	.75@.87½	.75@.87½	.....	.75@.87½	.50	.31¼@.50
Detroit	1.25@1.50	.80	1.25	1.25	1.25	.70	.30@.50
Kansas City	1.30	1.12½	1.12½	1.06	1.12½	.82½	.25@.70
Los Angeles	.62½	.50	.75	.75	.75	.50	.40
Minneapolis	1.10	.75	.80	.....	.90	.70	.45
New Orleans	.60@.80	.40@.50	.80@1.12½	.90	.80@1.12½	.50	.15@.20
New York	1.50	1.25	1.50	1.50	1.50	.81½	.50@.81¼
Philadelphia	1.00	.80	1.02½	1.00	1.02½	.40	.30@. 40
Pittsburgh	.60@1.50	.60@1.25	.60@1.37½	.....	.60@1.37½	.50	.40
St. Louis	1.50	1.25	1.35@1.47	1.25	1.47	1.00	.35@.70
San Francisco	1.10	.90	.90	1.00	*1.00*	*.62½*	.40@*.62½*
Seattle	.75@1.20	.50@.90	1.00	.90	1.10	.66	.40@*.50*
Montreal	1.25	*.50*@.75	.75	.70	*.60*@*.90*	.35@.50	.25@.40

Construction Cost and Volume Index Numbers

The June Cost Index (152.20) is 0.3 per cent under that for May and is 18.7 per cent below that for June, 1931. It is the lowest since December, 1916, at which time the Index touched 149.41. The May Volume Index (149) is 10.3 per cent greater than that for April and is 40.6 per cent smaller than that for May, 1931.


Volume
Cost
Labor output
Engineering News-Record
CONSTRUCTION COST AND VOLUME
INDEX NUMBERS
1913=100
Index
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1930
1931
1932

E.N.-R. Cost		E.N.-R. Volume	
June, 1932	**152.20**	**May, 1932**	**149**
May, 1932	152.78	April, 1932	135
June, 1931	187.23	May, 1931	251
1931 (Average)	181.35	1931 (Average)	220
1930 (Average)	202.85	1930 (Average)	260
1913 average	100.00		
1931		1931	
January	194.48	January	208
February	196.61	February	198
March	194.51	March	278
April	191.63	April	289
May	189.33	May	251
June	187.23	June	243
July	174.37	July	248
August	171.38	August	187
September	171.40	September	225
October	169.78	October	229
November	169.28	November	180
December	166.23	December	133
1932		1932	
January	162.48	January	121
February	161.82	February	105
March	157.24	March	97
April	153.12	April	135
May	152.78	May	149
June	152.20		

Current Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

Building Materials

PORTLAND CEMENT — Prices are for carload lots. For cement in returnable cloth bags add 40c. per bbl.; in non-returnable paper bags add 15c. per bbl., to following net prices:

	F.o.b.	Delivered		F.o.b.	Delivered
Atlanta	$2.10	$2.70	Kansas City	....	$1.50
Baltimore	1.87	1.97	Los Angeles	....	2.10
Birmingham	1.83	1.93	Minneapolis	$1.83	1.95
Boston	1.75	1.86	Montreal	2.18	2.25
Chicago	1.18	1.53	New Orleans	1.86	2.20
Cincinnati	1.52	1.64	New York	1.34	1.44
Cleveland	1.25	1.50	Philadelphia	....	1.95
Dallas	2.23	2.38	Pittsburgh	1.68	1.78
Denver	....	2.40	St. Louis	1.47	2.00
Detroit	1.47	*1.80*	San Francisco	....	1.95
Jersey City	1.53	1.63	Seattle	2.55	2.70

Current mill-prices per barrel to dealers, for carloads of 132 barrels or over, without including charge for four bags, f.o.b. Bag charges same as in preceding table:

Alpena, Mich	$1.20	Mason City, Ia	$1.10
Buffington, Ind	1.10	Norfolk, Va	1.61
Dallas, Tex	1.74	Northampton, Pa	1.21
Hannibal, Mo	1.10	North Birmingham, Ala	1.31
Hudson, N. Y	1.21	Richard City, Tenn	1.31
Independence, Kan	1.10	Steelton, Minn	1.61
Ironton, Ohio	1.06	Universal, Pa	1.21
Iola, Kan	1.10	Waco, Tex	1.65
La Salle, Ill	1.10	Wyandotte, Mich	1.20
Limedale, Ind	1.10		

SAND AND GRAVEL — Per ton, carload lots, 50,000 cu.yd.; gravel, size ¼-in.:

	Gravel		Sand	
	F.o.b.	Delivered	F.o.b.	Delivered
Atlanta	$1.95	$2.75	$1.50	$2.50
Baltimore	....	2.35	....	2.08
Birmingham, per cu.yd	....	3.00	....	2.40
Boston	1.50	1.58	1.00	1.10
Chicago, per cu.yd	....	2.25	....	2.25
Cincinnati	1.30	1.60	1.05	1.35
Cleveland	....	2.00	....	2.00
Dallas, per cu.yd	1.00	1.50	1.00	1.50
Denver, per cu.yd	....	1.80	....	1.35
Detroit	.50	1.65	.72	1.50
Kansas City	.75	1.25	.60	1.10
Los Angeles	1.35	*1.45*	.85	1.00
Minneapolis	....	*1.60*	....	*.65*
Montreal	1.50	....	1.25	....
New Orleans	1.50	2.50*	1.20	2.00*
New York, per cu.yd	1.60	2.69	1.00	1.69
Philadelphia	....	2.78	....	1.98
Pittsburgh	....	1.25	....	1.40
St. Louis	1.10	1.55	.80	1.35
San Francisco	....	1.75	....	1.75
Seattle, per cu.yd	1.75	....	1.75	....

*Cu.yd.

CRUSHED STONE — Per ton, size 1½-in., carload lots, 50,000 cu.yd., limestone:

	F.o.b.	Delivered
Atlanta	$1.95	$2.75
Baltimore	....	2.60
Birmingham	....	*Slag used*
Boston	1.70	1.88
Chicago, per cu.yd, 2,500 lb	....	2.25
Cincinnati	1.65	1.85
Cleveland	....	2.00
Dallas, per cu.yd., 2,500 lb	1.90	2.90
Denver, granite, per cu.yd., 2,700 lb	....	2.50
Detroit	*1.09*	1.95
Kansas City	*1.25*	2.00
Los Angeles	1.35	*1.45*
Minneapolis	....	*1.60*
Montreal	1.35	....
New York, per cu.yd., 2,800@3,000 lb	1.55	2.69
Philadelphia	....	2.73
Pittsburgh	....	3.50
St. Louis	1.35	1.65
San Francisco, trap rock	....	1.65
Seattle, per cu.yd., 3,000 lb	1.10	....

CRUSHED SLAG—Prices for carloads, per net ton, at plant:

	1½-In.	¾-In. Roofing	Slag Sand
Birmingham	$0.90	$1.15	$2.05	$0.55
Buffalo	1.35	1.35	2.35	1.35
Cleveland	1.10	1.10	2.25	.70
Toledo	1.20	1.20	1.25	1.10
Western Pennsylvania	1.25	1.25	2.00	1.25
Youngstown	1.10	1.20	2.00	*.75*

CONCRETE BLOCKS—Standard, 8x8x16-in., hollow, delivered to job, each:

Birmingham (5x8x12)	$0.084	Kansas City	$0.18
Boston	.18	Los Angeles	.15
Brooklyn and Queens	.12	Minneapolis	**.12**
Chicago	.175	New Orleans	.20
Cleveland	.165	Philadelphia	.15
Denver	.15	Pittsburgh	.15
Detroit	*.08*	St. Louis	.14

READY MIXED CONCRETE—Per cu.yd., 1:2:4, delivered:

Atlanta	$7.75	Los Angeles	$5.40
Birmingham	5.00	New Orleans	*6.20*
Boston	7.50	New York	7.00
Cincinnati	7.10	Pittsburgh	5.75
Dallas	6.00	St. Louis	6.65
Detroit	5.90	Seattle	5.35
Kansas City	7.00		

HOLLOW TILE—Building tile per block, delivered to contractors in lots of 2,000 pieces or over:

	4x12x12	6x12x12	8x12x12	10x12x12	12x12x12
Atlanta	$0.09	$0.11	$0.13	$0.20	$0.25
Baltimore	.10*	.14	.20	.22*	.30
Birmingham	.089	.122	.167	.219	.25
Boston	.08	.115	.145	.21	.325
Chicago	.0484	.063	.09	.1179	.13
Cincinnati	.06815	.09485	.129	.165	.184
Cleveland	.048	.066	.09	.117	.13
Dallas	.084	.121	.159	**.177**	.234
Denver	.0975	.135	.175	.2125	.25
Detroit	*.0505*	.11	.145	*.1175*	.215
Kansas City	*.0755*	*.098*	*.1405*	*.17775*	*.2075*
Los Angeles	.09425	.134	.188	.2325	.3115
Minneapolis	*.0635*	.09395	.1232	*.13425*	.2103
New Orleans	.085	.115	.16	.225	.255
New York	.075	.125	.14	....	....
Perth Amboy	....	....	....	.2388*	.2956*
Philadelphia	.105	.14	.215	.28	.34
Pittsburgh	*.0435*	.065	.088	.1165	.126
St. Louis	*.067*	.098	.12	.16	.20
San Francisco	.0765	.105	.1765	....	....
Seattle	.085	.115	.18	....	....

*At plant.

BRICK — Prices per thousand in carload lots, as follows:

	Common Backing		Face		Paving
	F.o.b.	Delivered	F.o.b.	Delivered	F.o.b. 3x8½x4-in.
Atlanta	$8.50	$14.00	$15.50	....	$32.00
Baltimore	....	*12.00*	....	$25.00	43.00†
Birmingham	10.00	12.50	20.50	23.00	27.00
Boston	....	13.00	....	27.50	47.00
Chicago	....	9.00	....	32.50	32.00
Cincinnati	13.50	16.00	....	24.00	36.50
Cleveland	12.00	14.00	....	*24.00*	33.00
Dallas	....	12.00	....	23.00	25.00
Denver	....	9.50	....	25.00	40.00
Detroit	*11.50*	*12.50*	26@30	28@32	25.00
Kansas City	12.00	*13.00*	*20.00*	*23.00*	35.00
Los Angeles	....	8.50	....	24.00	....
Minneapolis	....	8.50	....	28.00	....
Montreal	....	16.00	....	28.00	....
New Orleans	10.50	14.50	40.00	45.00	40.00
New York	10.00	11.50	28.00	30.00	45.00
Philadelphia	....	16.00	....	....	40.00
Pittsburgh	*8.00*	*10.00*	18.00	22.00	25.00
St. Louis	....	12.00	....	22.00	*30.00*
San Francisco	....	14.00	....	....	45.00*
Seattle	12.00	14.00	....	....	48.50

*2½x8½x4-in. †3½x8½x4 in.

LIME — Prices of hydrated, per ton, in paper; lump, per 180-lb. bbl., net:

	Hydrated: Finishing		Hydrated: Common		Common Lump,	
	F.o.b.	Delivered	F.o.b.	Delivered	F.o.b.	Delivered
Atlanta	$13.50	$18.00	$11.50	$15.50	....	$2.50
Baltimore	....	20.00	....	13.00	....	....
Birmingham	....	21.00	....	12.00	....	1.65
Boston	19.00	21.00	13.00	14.00	$2.00	2.25
Chicago	....	20.00	....	14.00	....	2.75
Cincinnati	11.00	12.00	9.40	10.40	....	....
Cleveland	10.50	14.00	8.50	12.00	....	2.50
Dallas	....	20.00	....	....	....	2.50
Denver	....	30.00	....	23.75	....	3.00*
Detroit	8.90	14.00	7.00	12.00	....	....
Kansas City	....	....	....	....	....	2.50
Los Angeles	....	26.00	....	18.00	....	2.00
Minneapolis	....	21.00	....	19.00	....	1.70
Montreal	....	18.00	....	8.00	....	....
New Orleans	14.75	22.50	11.58	14.00	1.66	1.95
New York	12.95	16.00	8.60	13.00	2.25*	3.15*
Philadelphia	....	18.00	....	14.50	....	14.00†
Pittsburgh	11.50	*13.00*	10.75	*12.25*	1.85	*2.35*
St. Louis	17.00	18.00	*12.00*	16.00	11.50†	12.50†
San Francisco	17.50	19.00	17.50	19.00	....	1.59
Seattle	....	*32.00*	....	24.00	....	2.80

*Per 280-lb. bbl. (net.) †Per ton.

LIMESTONE—Mill blocks, f.o.b. siding, per cu.ft.:
New York: Rustic buff, $1.37; Standard gray, $1.47; Standard, $1.57; Selected gray, $1.57; Selected buff, $1.67.
Boston: Rustic buff, $1.43; Standard, $1.56; Selected buff, $1.70.
Pittsburgh: Rustic buff, $1.56; Standard, $1.76; Selected buff, $1.86.
Atlanta: Standard, $1.26.

SLATE—Roofing, f.o.b. quarry, Bangor, Pa., net, per square;

No. 1 Clear	$8.25@$9.50
No. 1 Ribbon	6.75@ 7.50
Medium Clear	7.25@ 8.00

Road and Paving Materials

PAVING STONE — Granite, lots of 50,000 blocks, 4x8x4-in., dressed, f.o.b. city:

Atlanta	$3.00 per sq.yd.
Baltimore	3.00 per sq.yd.
Birmingham	76.25 per M.
Boston	105.00 per M.
Chicago, 5 in	3.80 per sq.yd.
Cincinnati	110.00 per M.
Cleveland	95.00 per M.
Detroit, 5 in	2.80 per sq.yd.
Kansas City	2.75 per sq.yd.
Minneapolis, 4½ in	2.80 per sq.yd.
Montreal	104.75 per M.
New Orleans	2.80 per sq.yd.
New York, 5 in	120.00 per M.
Philadelphia	105.00 per M.
Pittsburgh	115.00 per M.
St. Louis, 5 in	3.10 per sq.yd.

Current Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*.

Road and Paving Materials—Continued

WOOD-BLOCK PAVING — Prices f.o.b., in carload lots:

	Size of Block	Treatment	Per Sq.Yd.
Atlanta	3½	16	$2.25
Boston	3½	16	2.25
Chicago	3½	12	1.90
Kansas City	3½	16	2.00
Minneapolis	3½	16	2.50
Montreal	3½	16	2.63
New Orleans	3½	16	2.30
New York	3½	14	1.90
St. Louis	3½	16	2.10

CURBING—Per lin.ft., 5x16 in., straight, rough, f.o.b., in carload lots:

Atlanta	$0.41	Detroit	$0.45
Birmingham	.50	New York	*.75*
Boston	.75	Pittsburgh	.80
Dallas	.60	St. Louis	.75

ASPHALT—Paving asphalt, f.o.b., per ton. Packages are 350-lb. bbl. or 425-lb. drums, in carload lots:

	Packages	Tank-car or -boat
Atlanta	$18.60	$14.60
Baltimore (f.o.b. refinery)	16.00	12.00
Birmingham	.....	11.00
Boston	21.00	17.00
Chicago	22.50	15.50
Cincinnati (f.o.b. refinery)	.....	8.00
Cleveland	18.25	14.50
Dallas	.....	27.00
Denver	27.50	.....
Detroit	16.68	12.43
Kansas City (f.o.b. refinery)	**19.00**	**14.00**
Los Angeles (f.o.b. refinery)	18.00	12.00
Maurer, N. J. (Bermudez)	.....	25.00
Maurer, N. J. (Trinidad)	.....	21.00
Minneapolis (f.o.b. Twin Cities)	20.00*	16.30
Montreal	17.00	13.00
New Orleans (f.o.b. refinery)	16.00	12.00
New York (f.o.b. refinery)	16.00	12.00
Philadelphia	16.00	12.00
Pittsburgh	25.00	16.00
St. Louis (f.o.b. refinery)	12.00	8.00
San Francisco (f.o.b. refinery)	14.00	8.00
Seattle (f.o.b. refinery)	16.00	10.00

* Refinery.

LIQUID ASPHALT — Residual, hot application, f.o.b., in tank cars, 8,000 gal. minimum, per gal.:

Atlanta	$0.06
Birmingham	.06
Boston	.055
Cincinnati	.075
Dallas	.05
Los Angeles	.045
New York	.05
Pittsburgh	.035
St. Louis	.055

EMULSIFIED ASPHALT — For penetration and surface treatment, per gal.:

Boston, applied	$0.12
Cincinnati, f.o.b. refinery	.06
New York, applied	.15
Pittsburgh f.o.b. refinery	.04@.06
St. Louis, applied	.12@.13
Seattle, f.o.b. refinery	.055@.085

Iron and Steel

PIG IRON — Furnace, No. 2 foundry, per gross ton:

	Current	Mo. Ago	Yr. Ago
Birmingham	$11.00	$11.00	$12.00
Buffalo	16.00	16.00	17.00

	Pittsburgh	Chicago	Birmingham	Cleveland
STRUCTURAL SHAPES AND PLATES, per 100 lb., base, carload lots	$1.50	$1.70	$1.75	$1.78
CONCRETE REINFORCING BARS, ¼ in., billet, per 100 lb., carload lots	1.50	1.65	1.75	1.50
SHEETS, per 100 lb., carload lots:				
Hot-rolled No. 10	1.55	1.65	1.70	.....
Hot-rolled annealed No. 24	2.20	2.30	2.35	.....
Galvanized No. 24	2.85	2.95	3.00	.....
TERNE PLATES, per package, I.C., 8-lb. coating, 20x28 in.	9.50	.....	.....	.....
RIVETS, per 100 lb., ½ in., structural, carload lots	2.25	2.35	2.70	2.25
SHEETPILING, per 100 lb., base, carload lots	1.90	2.05	.....	.....
WIRE NAILS, per 100 lb., base, carload lots	1.95	2.00	2.40	1.95
HEAVY MELTING STEEL SCRAP, No. 1, per gross ton, at consuming point	*9.50*	6.75	7.00	7.00

TRIANGLE MESH—Plain, per 100 sq.ft., 4 in. x 4 in., in carload lots:

Style Number	Weight in Pounds Per 100 Sq.Ft.	Pittsburgh Mill	Chicago District Mill
032	22	$0.94	$0.96
049	28	1.19	1.22
068	35	1.45	1.49
093	45	1.87	1.91
126	57	2.31	2.37
153	68	2.75	2.82
180	78	3.16	3.24
245	103	4.17	4.27
287	119	4.82	4.94
334	138	5.59	5.73
395	160	6.48	6.64
036P	17	.71	.73
052P	24	1.01	1.03

TRIANGLE MESH—*Continued.*:

Style Number	Weight in Pounds Per 100 Sq.Ft.	Pittsburgh Mill	Chicago District Mill
072P	31	1.27	1.30
097P	40	1.64	1.68
049R	24	1.01	1.03
067R	31	1.27	1.30
089R	40	1.64	1.68

WIRE ROPE—Discounts from manufacturers' list prices on regular grades of bright and galvanized, Eastern Territory, New York, and East of Missouri River:

	Base
Cast steel round strand rope	25 %
Galvanized iron rigging and guy rope (add to list)	7½ %
Galvanized steel rigging and guy rope	12½ %
Plow steel round strand rope	40 %
"Special Steel" and extra strong cast steel, round strand rope	32½ %

Discount 5 points less than discount for Eastern territory: California, Colorado, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Texas, Washington and Wyoming. Discount 10 points less than discount for Eastern territory: Arizona, Idaho, Montana and Utah.

EXPANDED METAL LATH—Per 100 sq.yd., painted, f.o.b., in carload lots, 2.2 lb. per sq.yd., standard-mesh diamond lath:

Atlanta	$20.00	Los Angeles	$17.00
Birmingham	14.50	New Orleans	20.50
Boston	16.00	New York	13.50
Chicago	10.60	Pittsburgh	13.50
Cincinnati	11.00	St. Louis	17.00
Dallas	16.50	San Francisco	17.00
Kansas City	17.00	Seattle	19.00

STEEL FREIGHT RATES — Per 100 lb., effective Dec. 3, 1931, on finished steel products in the Pittsburgh District, including plates, structural shapes, merchant-steel bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc.; 40,000 lb. per car:

Atlanta, 36,000 lb	$0.60	Detroit	$0.285
Baltimore	.29	Kansas City	.59
Birmingham	.60	New Orleans, 36,000 lb	.69
Boston	.42	New York, 36,000 lb	.35
Buffalo	.255	Pacific Coast, 60,000 lb	1.17*
Chicago	.36	Philadelphia	.31
Cincinnati	.285	St. Louis	.41
Cleveland	.205	St. Paul	.60
Denver 60,000 lb	1.17	* All rail.	

Railway Materials and Supplies

STEEL RAILS—Standard rails have been $43.00 per gross ton since Sept., 1922, at which time the price was $40.00; other rails, per gross ton, f.o.b., as follows:

	Pittsburgh	Birmingham	Chicago
Light rails	*$32.00*@$34.00	$34.00	$34.00
Re-rolled rails	*21.00*@ *25.00*	.....	27.00

RAILWAY TIES — Prices f.o.b., per tie, for carload lots:

		6 In. x 8 In. by 8 Ft.	7 In. x 9 In by 8½ Ft.
Boston	Pine, untreated	$0.95	.....
	Pine, creosoted	1.45	.....
New York	Long-leaf sap pine, untreated	.90	$1.10
	Dense yellow pine, untreated	.65	.85
Birmingham	White oak, untreated	.90	1.05
	White oak, creosoted	1.45	1.55
	Southern pine, untreated	.45	.90
	Southern pine, creosoted	1.05	1.40
Chicago	White oak, untreated	1.05	1.35
	Oak, empty cell, creosoted	1.40	1.80
	Oak, zinc treated	1.25	1.65
	Southern pine, creosoted	1.15	1.50
Los Angeles	Fir, untreated	.47	.....
	Fir, creosoted	1.20	.....
St. Louis	White oak, untreated	*.70*	*1.20*
	Red oak, untreated	.70	1.15
	Red oak, creosoted	105	1.70
	Sap pine or cypress, untreated	*.55*	*.95*
San Francisco	Douglas fir, green, untreated	.45	.65
	Douglas fir, empty cell, creosoted	1.19	1.62
Montreal	Birch or maple, untreated	1.00	1.00
	Birch or maple, creosoted	1.25	1.55

TRACK SUPPLIES — Prices per 100 lb., f.o.b., for carload lots:

	Pittsburgh	Birmingham	Chicago
Angle bars	$2.75	$2.75	$2.75
Standard spikes	2.60	2.60	2.60
Tie plates	1.85	1.85	1.85
Track bolts	3.50	3.50	3.50

Pipe

WROUGHT STEEL PIPE — Discounts from standard list for delivery from warehouse, except at Pittsburgh, where prices are f.o.b. mill. List prices per ft. as follows: 1-in., 17c.; 3-in., 76½c.; 3½-in., 92c.; 6-in., $1.92.

	1 to 3-In. Butt Weld		2½ to 6-In. Lap Weld	
	Black	Galvanized	Black	Galvanized
Atlanta	44%	36.5%	42%	34%
Boston	55.5%	42.25%	51.35%	40.1%
Chicago	57.25%	44.71%	53.83%	41.29%
Cleveland	53.3%	42.3%	50.8%	37.8%
New York	56.14%	43.6%	52.72%	40.18%
Pittsburgh	64%	52.5%	61%	49.5%
St. Louis	51%	38%	48%	35%

Current Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

Pipe—Continued

CAST-IRON PIPE — Prices per net ton, for bell and spigot pipe, Class B and heavier, f.o.b. in carload lots; gas pipe and Class A, $3.00 per ton extra:

	4-In.	6-In. and Over
Atlanta	.....	$42.00
Boston	$39.00	36.00
Birmingham	*33.00*	*30.00*
Burlington	*33.00*	*30.00*
Chicago	*38.40*	*34.40*
Dallas	47.50	46.00
Los Angeles	39.00	36.00
New York	31.20	28.20
Pittsburgh	39.50	36.50
St. Louis	42.20	39.20
San Francisco	39.00	36.00

SEWER PIPE—Prices delivered, per foot, for standard pipe; 6, 8 and 12-in. are single strength and 18, 24, 30 and 36-in. are double strength:

	6-In.	8-In.	12-In.	18-In.	24-In.	30-In.	36-In.
Atlanta	$0.125	$0.21	$0.385	.....	$1.40.	.....	.....
Baltimore	.10	.30	.58	.....	1.93	.....	$6.50
Birmingham	.18	.30	.54	$1.02	1.95	$3.50	5.00
Boston	.18	.28	.55	1.35	2.27	4.75	5.90
Chicago	.18	.28	.54	1.25	2.25	4.75	6.00
Cincinnati	.108	.21	.324	1.05	1.755	3.528	5.4325
Cleveland	.135	.21	.405	1.125	2.025	4.824	7.38
Dallas	.23	.325	.586	1.106	1.95	3.68	5.00
Denver	.161	.23	.414	.816	1.44	.....	.....
Detroit	.135	.21	.405	1.05	2.50	4.75	.....
Kansas City	.21	.335	.52	1.00	1.90	3.60	.....
Los Angeles	.2175	.2825	.5085	1.1865	2.034	3.69	.....
Minneapolis	.18	.23	.46	1.20	1.85	3.20	4.26
Montreal	.30	.45	.75	1.95	2.60	.....	7.20
New Orleans	.18	.30	.54	1.02	1.95	.....	.....
New York	.17	.265	.52	1.30	2.34	4.47	6.86
Philadelphia	.0945	.147	.297	.80	1.44	2.304	3.28
Pittsburgh	.09	.18	.27	.62	1.22	2.45	3.68
St. Louis	.147	.235	.423	1.05	1.80	3.20	4.40
San Francisco	.175	.25	.45	1.05	1.80	3.00	4.50
Seattle	.22	.30	.54	1.26	2.16	2.50	5.50

CLAY DRAIN TILE—Per 1,000 lin.ft., f.o.b., in carload lots, 4 in.:

Atlanta	$50.00	Los Angeles	$60.00
Birmingham	50.00	New Orleans	40.00
Boston	45.00	New York	*31.50*
Chicago	40.00	Pittsburgh	80.00
Dallas	65.00	St. Louis	50.00
Detroit	40.00	San Francisco	67.50
Kansas City	70.00	Seattle	60.00

Miscellaneous

LINSEED OIL—Raw, in 4-bbl. lots, per lb., f.o.b.:

Atlanta	*$0.0627*	Minneapolis	*$0.073*
Birmingham	.08	Montreal	.062
Boston	.0775	New York	.07
Dallas	.073	Seattle	.075
Kansas City	*.069*		

WHITE LEAD—In oil, per 100 lb. keg., f.o.b.:

Atlanta	$12.50	Kansas City	$12.25
Birmingham	12.50	Los Angeles	11.50
Boston	13.00	New York	12.00
Dallas	13.00	Seattle	11.00

Note: Both white and red lead, dry, same prices as foregoing; red in oil, $1.50 higher.

CHEMICALS—Water, sewage treatment, road work, f.o.b., carlots, New York:

Bleaching powder, in drums, f.o.b. works, per 100 lb.	$1.75
Calcium chloride, 77-80%, flaked, in 400-lb. drums, f.o.b. works, per ton	21.00
Chlorine, cylinders, per lb.	.04
Silicate of soda, in drums, f.o.b. works, per 100 lb.	1.35
Soda ash, 58%, in bags, per 100 lb.	1.15@1.17½
Sulphate of aluminum, in bags, per 100 lb.	1.25
Sulphate of copper, in bbl., per 100 lb.	2.75

MANILA ROPE—The number of feet per pound for the various sizes is as follows: ¼-in., 6-ft.; ½-in., 1-in.; ¾-in., 4-ft., 5-in.; *1-in.*, 3-ft., 8-in.; *1¼-in.*, 2-ft., 5-in.; *1½-in.*, 1-ft., 8-in. Following prices are per lb. for ¼-in. and larger, delivered in 1,200 ft. coils:

Atlanta	$0.184	Kansas City	*$0.22*
Baltimore	.225	Los Angeles	.1725
Birmingham	.20	Minneapolis	.175
Boston	.20	Montreal	.175
Chicago	.175	New Orleans	*.185*
Cincinnati	.21	New York	*.165*
Cleveland	21	Philadelphia	.21
Dallas	.25	St. Louis	.155
Denver	.20	San Francisco	.15
Detroit	.185	Seattle	.175

BUILDING PAPER—Black, 50-lb. per roll of 500 sq.ft., in carloads, f.o.b., producing point $2.05

SLATERS FELT—In carloads, per roll, f.o.b., producing point **$0.53**

PREPARED ROOFING—Per square, f.o.b., in carload lots:

	Single Shingles*	Strip Shingles†	Rolls‡
Atlanta	$5.85	$6.25	$2.05
Boston	6.75	6.50	2.65
Dallas	5.25	4.50	2.25
New Orleans	.....	6.50	*2.00*
New York	6.50	6.25	2.50
Seattle	.....	6.60	2.55

*Slate finish, sufficient to cover 100 sq.ft.
†4 in 1, hexagonal shape, with Underwriters' label.
‡Slate surfaced, in rolls weighing 85 to 90 lb.

ROOFING MATERIALS—In carload lots, f.o.b.:

	Asphalt Felt, per 100 Lb.	Tar Felt, per 100 Lb.	Asphalt Coating, per Gal.	Tar Pitch,* per Ton
Atlanta	$2.23	$2.23	$0.45	$44.50
Boston	2.50	2.50	0.35	30.00
Dallas	3.25	3.50	1.00	42.00
Denver	2.00	2.00	.90	18.00
New Orleans	.....	.....	.....	22.50
New York	2.40	2.40	.34½	28.00
Seattle	2.40	2.40	.55	27.90

*In 350 lb. barrels.

WINDOW GLASS—Discounts from latest jobbers' list, dated Sept. 15, 1928, for sizes above first three brackets:

	Single Thickness		Double Thickness	
	A Quality	B Quality	A Quality	B Quality
Atlanta	85%	85%	85%	85%
Birmingham	89%	91%	89%	91%
Boston	85%	90%	86%	90%
Dallas	85%	85%	87.5%	89.5%
Kansas City	80%	80%	80%	80%
New York	87%	89%	87%	89%
Pittsburgh	87%	89%	87%	89%
Seattle	90@10%	90@20%	90@10%	90@20%

EXPLOSIVES—Price per pound for dynamite delivered:

	Gelatin 40%	Gelatin 60%		Gelatin 40%	Gelatin 60%
Atlanta	$0.215	$0.2375	Los Angeles	$0.1725	$0.1925
Baltimore	*.21*	*.225*	Minneapolis	.18	.195
Birmingham	.13	.1525	Montreal	.17	.195
Boston	.225	.25	New Orleans	.195	.22
Chicago	.17	.195	New York	.245	.2675
Cincinnati	.22	.245	Philadelphia	.215	.24
Dallas	.28	.30	St. Louis	.1975	.2175
Denver	.19	.2125	San Francisco	.155	.18
Kansas City, Mo.	.2025	.2225	Seattle	.1525	.175

Lumber

LUMBER—Per M. ft., b.m., No. 1 Common, rough, in carload lots:

PINE

	1 x 6 In.* F.o.b.	1 x 6 In.* Del.	1 x 8 In.* F.o.b.	1 x 8 In.* Del.	3 x 12 In.† F.o.b.	3 x 12 In.† Del.
Atlanta	$14.00	.....	$15.00	.....	$35.00	$50.00
Baltimore	.....	$46.00	.....	.....	.....	*70.00*
Birmingham	.....	15.00	.....	$15.00	.....	*18.00*
Boston	36.00	40.00	37.80	42.00	45.00	50.00
Chicago	.....	.....	.....	.....	.....	62.50
Cincinnati	.....	28.00	.....	28.00	.....	35.00
Cleveland	.....	.....	.....	.....	.....	52.00
Dallas	.....	32.50	.....	32.50	.....	47.50
Denver	33.00	.....	33.00	.....	.....	.....
Detroit	29.00	29.00	30.00	30.00	32.00	32.00
Kansas City	21.00	.....	23.00	.....	28.00	*52.00*
Los Angeles	.....	.....	.....	.....	.....	.....
Minneapolis	.....	31.00	.....	31.00	.....	36.00
Montreal	.....	.....	.....	.....	.....	40.00
New Orleans	.....	15.50	.....	16.50	.....	52.00
New York	23.00	*25.00*	24.00	*26.50*	*25.00*	*27.00*
Philadelphia	.....	.....	.....	.....	.....	55.00
Pittsburgh	.....	30.00	.....	30.00	.....	*45.00*
St. Louis	*23.00*	*28.00*	*24.50*	*29.50*	47.00	52.00

FIR

	1 x 6 In.* F.o.b.	1 x 6 In.* Del.	1 x 8 In.* F.o.b.	1 x 8 In.* Del.	3 x 12 In.† F.o.b.	3 x 12 In.† Del.
Baltimore	.....	.....	.....	.....	.....	*$46.00*
Boston	$34.20	$38.00	$36.00	$40.00	$38.70	43.00
Chicago	.....	.....	.....	.....	.....	44.52
Cincinnati	.....	.....	.....	.....	.....	42.50
Cleveland	.....	.....	.....	.....	.....	52.00
Dallas	30.00	31.00	29.00	30.00	38.50	40.00
Denver	33.00	.....	33.00	.....	44.00	49.00
Detroit	.....	.....	.....	.....	30.00	30.00
Kansas City	.....	.....	.....	.....	31.50	*39.00*
Los Angeles	39.00	41.50	39.00	41.50	43.00	45.50
Minneapolis	.....	31.00	.....	31.00	36.00	40.00
Montreal	.....	.....	.....	.....	.....	41.75
New Orleans	.....	20.00	.....	20.00	.....	42.50
New York	22.50	24.50	23.00	25.00	25.00	*27.00*
Philadelphia	.....	.....	.....	.....	.....	40.00
Pittsburgh	.....	48.00	.....	48.00	.....	*50.00*
St. Louis	31.00	36.00	31.00	36.00	35.00	40.00
San Francisco	.....	.....	.....	.....	.....	35.00
Seattle	10.00	11.00	10.00	11.00	14.00	15.00

*Form lumber, 16 ft. lengths. †Planks, 20 ft. lengths.

PILES—Prices of Nichols Bros., 90 West St., N.Y.C., per linear foot, pine, with bark on, f.o.b., New York; delivered from barge, 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	*$0.10*	*$0.155*
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	*.14*	*.205*
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	*.16*	*.225*
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	*.195*	*.235*
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	*.2125*	*.285*
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	*.275*	*.385*
14 in.—2 ft. from butt	5 in.	85 to 89 ft	*.315*	*.425*